

# Preface

## Why Seaweed Phylogeography, Why Now?

Although species-level research on seaweeds, at least with regard to climate change, lags behind similar work in terrestrial environments, there is no reason that phycologists could not model a research program based on the successes of terrestrial botanists, foresters, and agricultural scientists.

Harley CDG et al. (J Phycol, 2012, 48:1064–1078)

Seaweeds (marine macroalgae) are a group of photosynthesizing organisms that generally attach to rock or other hard substrata in coastal areas. Ecologically, many species form dense forests to provide protective habitats for a wide range of flora and fauna, maintain coastal community by modifying physical structure, form the base of the marine food chain, and serve as the primary producers and carbon sinks. It is estimated that, globally, kelps can assimilate about  $1.8 \text{ kg carbon m}^{-2} \text{ year}^{-1}$ , exceeding the primary production of marine phytoplankton by up to ten times. Economically, seaweeds are used by humans for food, feed, fertilizer, cosmetics, mariculture, pharmaceutical industry, and biofuels.

Seaweeds are critical components of marine biodiversity and play vital roles in ecosystem function, yet many species are vulnerable to global environmental change and anthropogenic impacts. Understanding how such impacts have affected the genetic diversity and biogeographic patterns of seaweeds will facilitate predictions of how seaweeds will respond to ongoing global environmental change, and thus inform management and conservation strategies.

Over recent decades, rapidly evolving DNA sequencing technologies and ever-improving analytical frameworks have allowed us to begin to understand broadscale patterns of genetic diversity of seaweeds, and to interpret the processes affecting their evolution and ecosystem structure. In particular, phylogeographic inferences of how seaweeds responded to Pleistocene climate change cycles suggest that many experienced localized extinction and large-scale range contraction. Phylogeographic research has also shed light on how seaweeds have evolved and

dispersed, how invasive species have affected marine ecosystems, and how seaweeds have adapted to heterogeneous habitat niches. Such knowledge is crucial for linking the diversification and evolution of seaweeds to various biological, environmental, and climatic factors for marine biodiversity planning and conservation purposes.

The book *Seaweed Phylogeography: Adaptation and Evolution of Seaweeds under Environmental Change* provides a collection of articles summarizing advances in population genetics and the evolutionary biogeography of seaweeds over the past two decades. It is intended for students at the senior undergraduate and graduate levels as well as professional researchers interested in phycology, marine biology, ecology, and evolutionary biology. While not attempting to comprehensively cover all research in seaweed phylogeography, we hope that this book achieves its goal of providing a useful and interesting summary of major recent discoveries and avenues for future research.

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