

Chapter 1

Patterns in the Marine Environment

CHAPTER SUMMARY

Most space for life on earth is in the vast oceans and seas. Life began in the oceans and remained confined to this environment for hundreds of millions of years. Most major groups (phyla) of animals never left it. The wide expanse of the oceanscape changes dramatically, from undersea mountain ranges to sediment plains and coral reefs to forests of kelp. Patterns of organisms, so obvious at the shore, are also evident from the poles to the tropics, from coasts to ocean centres, from the shallows to the deep abyss, and from millions of years ago to the present day. Patterns occur in species richness, abundance, ancientness, or size, all of which are indicators of powerful changes on the planet surface in time and space. Oceans have widened or been compressed, risen and fallen, heated and cooled and remain dynamic places; most will have changed drastically in just the lifespan of the reader of this book. Examining some of the major patterns in organisms and their biology gives a strong insight into the processes that determine success and evolution of life on earth.

1.1 Introduction

Humans are a land-living species and consequently most familiar with the terrestrial environment, yet the earth is a blue planet and the oceans cover >70% of its surface. Close to the continents this aquatic ecosystem takes the form of shallow seas just a few hundred metres deep known as the **continental shelf**. Most of the oceanic habitat (and 51% of the earth's surface) is nearly 4000 m deep. This three-dimensional environment is populated throughout its depth by many organisms. The steep rises up to the continental shelf contrast with the large sediment-covered basins that span tens of thousands of square kilometres broken only by the undersea mountain ranges of **mid-ocean ridges**. At these locations oceanic crust is formed and gradually moves outwards,

● Our impoverished knowledge of the ocean's inhabitants is emphasized by the fact that it is not just new species that are described, but that entirely new classes or phyla (the highest taxonomic levels of animal types) have been discovered in just the last couple of decades.

pushing continents apart, and eventually disappears down beneath continental crust, forming deep oceanic trenches. Considering its volume, the vast majority (*c.*99%) of the earth's habitat is marine and where most major types of animal (phyla) evolved and continue to live exclusively. Most of the vast water column and seabed (**benthic**) habitat remains unobserved by human eyes. New species are still routinely found in deep-sea samples and even some of the larger animals on earth which live there, megamouth sharks and giant squid, have never been seen alive in their natural habitat.

Standing at the edge of a forest looking out over a prairie, lake, or into the tree canopy, it is easy to see how fragmented the land can be.

Box 1.1 A new phylum

In 1995 an entire new phylum of tiny animals, the Cycliophora, was reported from a discovery two years earlier. As it is only 350 μm in size and superficially resembles individuals of several other phyla of small animals (Gastrotricha, Rotifera, and Entoprocta), it could be considered unsurprising that such animals are still being discovered. Surprisingly, though, the single species (*Symbion pandora*) lives on the mouthparts of *Nephrops norvegicus* – a very common, well studied and widely consumed species, often referred to as scampi. *S. Pandora*, or the 'Pandora', attaches to its host using a sucker and suspension feeds on particles in the water, a small parasitic male (whose sole purpose seems to be for breeding) is also shown attached in the picture below.

