
Longhurst Areas

Ecological Geography of the Sea

by A. Longhurst

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We were all waiting for this book. As pointed out in its introduction, a 'geography of the sea' – that is, a rigorous definition of 'provinces' suitable for describing, in standardized fashion, the distribution of all marine organisms – did not exist despite a history of oceanographic research starting with the Challenger Expedition (1872–1876). Numerous maps did exist in which this or that oceanographic parameter or the distribution of a few organisms had been used to draw provinces or 'Large Marine Ecosystems' (LME) of some sort. However, no test had been conducted of the ability of these proposed maps to predict distributions other than those from which they were derived: circularity reigned supreme.

Reasons for this are easy to imagine, from the excessive preoccupation of various specialists with their favorite taxonomic groups, to the absence, before the recent computer revolution, of analytical tools up to the task. However, the real reason is probably that developing a truly synoptic vision of the ocean was impossible before the advent of satellite-based oceanography.

Satellites cannot see very deep into the sea, nor can they see very much – at least as far as those satellites are concerned that civilians know about. However, what satellites do see is the very stuff that generates

fundamental differences between ocean provinces: sea surface temperatures and their seasonal fluctuations, and pigments such as chlorophyll, and their fluctuations. Marine systems differ from terrestrial ones in that their productivity is essentially a function of nutrient inputs to illuminated layers. This gives a structuring role to the physical processes that enrich surface waters with nutrients from deeper layers, such as wind-induced mixing, fronts, upwelling, etc. Thus, the location, duration and amplitude of deep nutrient inputs into different oceanic regions (as reflected in their chlorophyll standing stocks, and described in *Ecological Geography of the Sea*) largely define the upper trophic level biomasses and fluxes that can be maintained in these regions. This is the reason why satellite images reflect fundamental features of the ocean, whereas maps based on the distribution of various organisms – even 'indicator' organisms – can only reflect second-order phenomena.

Alan Longhurst is among the very first to have fully realized these implications of satellite oceanography, and to have followed up on them. This led to an estimate of global marine primary production much superior to earlier attempts¹, based on a stratification by 'provinces' defined in another major contribution². Then Alan Longhurst went into retirement to run an art gallery in southern France with his wife.

The book presented here was written thereafter, largely by popular demand: many colleagues adopted the provinces proposed in these earlier works as standard for work now published³, or still in preparation, but wanted more details on what it was obvious to call 'Longhurst Areas'⁴. For example, Longhurst Areas will provide the architecture for several projects in which I am involved, whose products are expressed on a global basis. This will involve stratifying

global marine fish biodiversity in forthcoming releases of FishBase⁵ (<http://www.fishbase.org>). It will also involve replacing the 18 'FAO Statistical Areas' currently used for raising upper trophic level biomass fluxes from local ecosystem models to regional estimates, and thence to the global ocean^{6,7} (<http://www.ecopath.org>).

This work will be aided not only by the existence of Longhurst's classification of ocean provinces – whose reliability can be assessed in the first 98 pages of the book, which discusses conceptual and methodological issues – but also by the detailed description of the 51 neritic and oceanic provinces presented in the next 300 pages. The work of various research groups will undoubtedly modify these descriptions. However, most of this follow-up work will only add details to one or other Longhurst Area. The excellence of this book guarantees that the overall structure will remain, and that the well deserved eponym will stick.

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