

New Ocean Provinces for Evidence-Based Management of Marine Ecosystem Services: Five-years of progress under the transdisciplinary NEOPS science program

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The ways in which marine ecosystems and biogeochemical cycles respond to global environmental change is an increasingly important issue for today's science community. Understanding the human dimensions linked to these dynamics is crucially important to determine how the benefits that humans have been receiving from the ocean will change in the future, and how ocean management can be optimized in order to promote sustainable development. To answer these questions, we launched a five-year transdisciplinary project: NEOPS (New Ocean Paradigm on its Biogeochemistry, Ecosystem and Sustainable Use). In addition to exploring pathways to sustainable use of marine ecosystem services, an essential part of the project has been to specify new ocean provinces. Material cycling and ecosystem functions determine the boundaries of these provinces, so they provide a firm scientific base on which to build a legal and economic framework for sustainable ocean management. Longhurst (1995) proposed a single universal map of ocean provinces, but the NEOPS project is preparing around 100 maps based on physical (T, S, mixed layer, eddy, etc), chemical ($p\text{CO}_2$, pH, nutrients, BSi, CDOM, flux, etc), and biological (Chl, N fixation, 18S rDNA of phytoplankton, zooplankton, squid, toothed whales, etc) data. NEOPS is also planning to prepare maps of ocean provinces tailored to specific needs (e.g., ocean provinces for tuna fisheries) through the application of user-friendly tools such as Google Earth.

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