Preface

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Abstract: This introductory section attempts to synthesise the main messages of the broad spectrum of papers written for this issue, which includes: (a) public health aspects of environmental changes, (b) proposals for an improved characterisation of El Niño Southern Oscillation (ENSO), a general overview of impact of ENSO on human health, and the effects of climate variations on human health in general and on variations of particular diseases such as cholera and malaria including mathematical modelling aspects, (c) the impact of ENSO on terrestrial and marine biodiversity, particularly on small pelagic fish, and the effects of port dredging on marine biodiversity, (d) the impact of combined high altitude hypoxia and other environmental factors prevalent in high altitude settings, (e) the combination of diatom populations as indicators of river water quality and (f) the effectiveness of access to improved drinking water at point of use on diarrhoeal morbidity and mortality. Particular emphasis is devoted to the inequitable burden of environmental change on population health and biodiversity in the Southeast Pacific Basin.

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Environmental changes not only greatly influence living and health conditions of human populations through many causal pathways, but they have also wide ranging consequences on biodiversity. In this issue of the Journal devoted to Environment and Health in Southeast Pacific Basin, particular emphasis has been paid to Latin American contributions, especially to those from Peru, Chile and Mexico. This is in no way casual. It is in fact the result of several years of a very enriching exchange of academic experiences between us, scientists with different expertise fields, a marine biologist and a paediatrician. A shared concern that soon became clear to us was that related to how environmental changes are affecting health status of human beings and quantity and quality of non-human species, and what can be done for halting and reversing the situation, particularly in this part of the world. Therefore, this issue will cover papers ranging from impact of environmental changes on human health to effects on biodiversity, as well as possible preventive or corrective interventions, encompassing a wide range of scenarios, from the coastline to high altitude settings.

Climate changes (mostly driven by human activities), environmental pollution and other environmental risks, such as lack of access to safe drinking water and basic sanitation, account for a substantial burden of death and disease, particularly in poor countries of the world. Latin America, although showing a sustained macroeconomic growth for several years, particularly in some countries such as Chile, Brazil, Colombia and Peru, is still a setting where unacceptable inequities exist. A disproportionate burden of disease and death attributable to environmental causes affects mostly the poorest segments of the population.

Also, poorly regulated mining activities, unplanned urbanisation, gas emissions and uncontrolled automotive proliferation are all environmental problems that affect the health status of those living in this part of the world.

Specific environmental challenges to be faced in Andean settings, besides hypoxia, are those related to smelting industries, changes in biodiversity and profound lifestyle changes of native communities occurring as a result of increased mining activities and open trade.

On the other hand, large oceanographic events like the El Niño Southern Oscillation (ENSO) generate huge impacts on terrestrial and marine environments, modifying the abundance and distribution of species. Changes in the oceanographic climate caused by high-intensity ENSO events have an important role as a disturbing process at temperate latitudes along the eastern Pacific coastline, producing bathymetric migrations of organisms, invasions of exotic species, behavioural alterations and positive or negative changes in abundance, the latter of which may reduce population densities to local extinction (Vásquez et al., 2006). Modifications of the coastal biota may be observed on both local and regional geographic scales.

Although the literature on environmental changes and on its effects on global human health and biodiversity is increasing steadily, reflecting the interest of the global scientific community on this complex problem, we badly needed an integral perspective from the Southeast Pacific Basin, and thus this issue is timely and welcome.

First, a call for a better characterisation and understanding of ENSO is made, with a critical review of before–after and correlational approaches, stressing the need for proper and more accurate information to improve our perspective of its impact, while providing study cases from rocky intertidal communities in northern Chile (Camus, this issue).

Then, a general overview of impact of ENSO on human health is presented, which includes aspects such as modifications of human quality of life as a consequence of environmental degradation, reduced production of specific crops and impacts on the population dynamics of harmful microorganisms such as problematic microalgae, as well as the ecology of vector–pathogen–host relationships (Luxoro, this issue).

A refreshing review on the 1991 Peruvian cholera outbreak and its possible link with ENSO revisits the evidence supporting the existence of an environmental niche for *V. cholerae* O1 in Latin America. It acknowledges that the temporal association between ENSO and the last South American cholera outbreak, although it points to a causal relationship, is still insufficient, needing further studies that explore data for longer periods of time (Salazar-Lindo et al., this issue).

Mathematical modelling is an important resource for predicting the effects of ENSO, other environmental changes on human health and biodiversity. The potential of an autoregression mathematical model is reported for assessing the relationship between meteorological variables and the incidence of *P. falciparum* and *P. vivax* in malaria endemic regions of the northern coast of Peru (Ventosilla et al., this issue). While the authors acknowledge concerns on the accuracy of the gathered secondary data and the rather short period of observation, they prompt further assessment of this model, including additional variables such as vector density and vegetation index.

The pelagic ecosystem is important for man, due to its high productivity and the accessibility of upwelling zones. As for the effects of ENSO on the distribution of small pelagic fish off the west coast of Baja California, it seems that in the presence of climatic anomalies like ENSO, small pelagic fish are concentrated in specific areas not influenced directly by these phenomena, and are therefore available for fishing in abundance. Hence the regulation of fishery management an important issue to be discussed and determined in all involved countries and regions (Rojas-Méndez and Mendoza, this issue).

There are limited data on the impact of port activities such as dredging, construction and shipping flows, on conservation of marine biodiversity and management of benthic marine resources, particularly in Chilean waters (Allan et al., this issue). The construction of Port Angamos terminal in Mejillones Bay, Chile, required dredging of more than 1 million m^3 of sediment from depths of 2–20 m. Dredging caused alterations of the physical environment that were reflected in the benthic communities, which showed reduced richness, abundance, biomass and diversity, along with diminished community complexity, in the study sites closest to the port (Allan et al., this issue).

One of the most reliable techniques to assess water quality in river and stream relies on the use of bioindicators, which are sensible to ecological stressors. Diatoms are one of the most used bioindicators to assess water quality. One contribution in this issue shows that the combination of diatom populations both tolerant to organic pollution and abnormal morphology in the algal samples indicate a low water quality of the Mantaro River at a specific site (downstream the La Oroya town in Peru), most likely as a product

of raw domestic water discharge and metallurgic-derived heavy metals carried along the stream (Tapia, this issue).

Hypoxia is a fundamental characteristic of high altitude settings, but there are additional factors such as cold and increased ultraviolet radiation that pose additional challenges to those organisms living in such environments. In addition, there are prevalent environmental changes related closely to human activity, including climatic change in the Andean mountains, and increased outdoor and indoor pollution. Mining activities, while representing a unique opportunity for wealth generation, may contribute substantially to alteration of environmental conditions and of the lifestyles of native communities. Finally, most populated high altitude settings in the Andean region are characterised by rampant poverty and child malnutrition. The role of these additional environmental factors in shaping the responses of resident organisms is an area largely neglected in high altitude research (Rivera-Ch et al., this issue). High altitude hypoxia very likely interacts with these additional environmental factors, modifying the effects of pure hypoxia on the responses mounted (Rivera-Ch et al., this issue), but clearly more research is needed to better understand the combined effects of such factors prevalent at high altitude, in order to eventually identify effective public health interventions for preventing or alleviating the resulting negative consequences (Rivera-Ch et al., this issue).

Finally, the systematic assessment of the effectiveness of interventions related to access to improved drinking water shows that access to microbiologically improved water at the household level seems to have a measurable impact on diarrhoeal morbidity and mortality in developing countries (Huicho et al., this issue). It seems therefore that the time has come for promoting scaling-up of such intervention, although some specific aspects related to implementation under non-controlled scenarios still need further research.

References

Vásquez, J.A., Alonso Vega, J.M. and Buschmann, A.H. (2006) 'Long term variability of kelp communities in northern Chile and the 1997-98 ENSO', *Journal of Applied Phycology*, Vol. 18, pp.505–519.