
Introduction

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Biographical notes: Daniel A. López holds a PhD in biology. He is a Professor and Ex-Principal of the Universidad de Los Lagos, Osorno, Chile. He is the author of more than 50 publications in ISI journals on ecological aspects of aquatic resources (marine and fresh water), and aquaculture. In addition, he is a member of the national study committee and the postgraduate commission on animal health and production pertaining to the national scientific research commission, maximum organisation for the promotion, management and funding of science in Chile, and a member of the national aquaculture commission.

Boris E. Bravo-Ureta received his PhD in agricultural economics from the University of Nebraska and is now Professor of Agricultural Economics and Executive Director of the Office of International Affairs at the University of Connecticut in Storrs. His expertise is in production economics, development economics and project evaluation. He has published widely in peer-reviewed journals focusing on the forces leading to the growth of agricultural output with special reference to technical efficiency, technological change, economies of size, supply response, and natural resource management on hillside agriculture. His work has concentrated on various countries, including Argentina, Bolivia, Chile, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Paraguay, Senegal and the USA. His work has been funded by the US Agency for International Development, the Inter-American Development Bank, the Norwegian Agency for Development Cooperation, the Central American Bank for Economic Integration, Chemonics International, TechnoServe, the US Department of Agriculture, the Chilean Ministry of Agriculture, Fundación Chile and the Storrs Agricultural Experiment Station.

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The world-wide development of aquaculture is increasing, and in marine waters the interest is centred on high trophic level organisms, such as salmon. Originating in Norway, salmon farming developed and reached commercial prominence in Chile during the 1980s. Today, Chile is the second largest producer in the world. The development of this productive activity has been driven mainly by private profit-maximising objectives, which has caused a series of controversies regarding environmental and social sustainability. Specific criticisms have focused on monocultures that do not take into account the multiple environmental interactions associated with such activities. Moreover, in most cases the regulatory framework does not have an ecosystemic approach. These issues have not received adequate attention and as a result there have been severe environmental effects.

In context just described, Chile provides an ideal setting for analysing the development of aquaculture and how environmental and economic variables interact. Culturing high trophic level species, such as salmon, requires exogenous food that produces environmental imbalances owing to increases in the waste material that reaches the sediment and in the dissolved nutrients in the water column. Furthermore, mollusc and alga cultures have been developed on a large scale, occupying almost all the coastal areas of southern Chile (López et al., 1988; Buschmann et al., 1996). During the last 10 years important scientific and technological advances have been made towards an integrated and sustainable aquaculture system (see reviews by Buschmann et al., 2001; Chopin et al., 2001; Troell et al., 2003; Neori et al., 2004). However, the application of these advances still requires additional work and further discussion.

A major objective of the symposium *Aquaculture, Ecology and Economics: Towards a Sustainable Paradigm*, held in Puerto Varas (Chile), was to integrate different visions of the study of aquaculture and the ecosystem, and basic and applied knowledge in a setting where this productive activity takes place. An additional objective was to incorporate modern economic perspectives that consider the environmental dimension with the overall goal of advancing the discussion surrounding the development of aquaculture. Some of the highlights of the contributions contained in this Special Issue of *IJEP* are presented below and the respective authors are acknowledged in parentheses.

Disease prevention is one of the main areas that has to be addressed to develop a sustainable aquaculture process. To do this, it is necessary to recognise that it is not possible to understand diseases without establishing the interactions between aquaculture and the environment (De Guise et al.). Aquaculture development and eutrophication of coastal zones is a major area of current debate. Molecular tools are also important to establish many economic and environmental effects, such as harmful algal blooms (Lin).

Aquaculture in Chile has undergone significant development during the last 20 years, and the farming of molluscs, especially filter-feeders such as mussels (*Mytilus chilensis*) and scallops (*Argopecten purpuratus*), has exhibited spectacular growth (López et al.). However, the cultivation of algae seems stable during the last several years in Chile. On the other hand, several projects related to the cultivation of seaweeds for human use and animal feed are being developed, and this activity is expected to enter into a diversification and growing phase in the near future (Buschmann et al.).

The Chilean policy structure towards the development of aquaculture is described, with special reference to growth, sustainability, protection of sanitary heritage, social equity, public institutional setting, the legal framework, and research and capacity building (González).

Non-market attributes of aquaculture and sustainable seafood production are incorporated in the empirical analysis of benefits and costs associated with this activity. The implications for the development of aquaculture are also discussed (Johnson et al.). A review of the literature dealing with bio-economical modelling and its application to salmon culture is presented, and this approach is proposed as a suitable methodology to assess the performance of living production systems (Pomeroy et al.).

The last paper in this issue includes an outreach model that can be used in various geographical regions to enhance the capacity of local communities and the aquaculture industry to adopt better production practices (Getchis and Monahan).

In conclusion, it seems clear that an integrated approach is needed for the profitable, environmentally friendly and sustainable development of aquaculture in southern Chile as well as in any other region of the world. The literature strongly suggests that these goals are attainable, but additional interdisciplinary interactions, such as this Symposium, where ecological and economic issues are integrated into the discussion, are required.

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