

Deep-sea fisheries off Latin America: an introduction

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Recent assessments of the state of the world's marine capture fisheries demonstrate that global catches have attained (or surpassed) maximum sustainable levels in the last two decades (Pauly *et al.*, 2002). These reports also point out three critically related global trends: (a) fishing efforts in developing countries have increased in order to meet the high demands of the "overfished" developed world (Garcia & Grainger, 2005; Pauly *et al.*, 2005), (b) catches have concentrated on smaller organisms of lower trophic levels (Pauly *et al.*, 1998), and (c) fishing has gone deeper (Morato *et al.*, 2006). It has been argued that developing coastal countries, concentrated in the Southern Hemisphere, have developed their offshore fishing capacity (through national fleet enhancement or foreign fishing agreements) in order to further production of both large, high-value and small, low-value fish (and shellfish); the former are destined for international markets and the latter to supply domestic food demands. Worldwide, this process has also been associated with the progressive occupation of deeper areas by commercial fleets, initially in search of better catches of shelf targets but eventually aiming at the exploitation of some highly profitable, typically deep-water species (Japp & Wilkinson, 2007).

Largely embedded in the developing world, Latin America may be seen as a good example of such trends. It comprises 20 coastal countries whose Economic Exclusive Zones (EEZs) extend into the southwestern Atlantic, eastern Pacific, Southern Oceans, and Caribbean Sea. The region has historically contributed over 15% the world's marine fish production, although most of this has concentrated on fishmeal produced by massive catches of small pelagic fish in upwelling zones off Peru and Chile. In recent decades, however, Latin American fisheries production not only increased continuously but also diversified, shifting its focus to the production of fish for human consumption (as opposed to fishmeal) and trading with the USA, EU,

and Japan (Wiefels, 2003). As the new millennium progressed, Latin America became a major net export region reporting, in 2006, an 8 billion US\$ surplus in fish and the fish products trade (Garcia & Grainger, 2005; FAO, 2009). Notwithstanding, several large Latin American countries have also experienced a growing domestic demand for seafood, and regional fishery development seems to have been motivated by obtaining hard currency rather than food security (Wiefels, 2003). In the context of said fishing development history, it stands to be asked: has fishing also gone deeper off Latin American countries?

Deep-water fishing, normally defined as fishing conducted near the seafloor beyond the continental shelf break (including slope areas, seamounts, and seamount ridges), emerged in the 1950s through pioneer operations of Russian trawlers on the northern mid-Atlantic ridge (Troyanovsky & Lisovsky, 1995; Japp & Wilkinson, 2007). In the following decades (1960-2000), fishing technologies advanced and deep-water fisheries expanded to all oceanic regions of the world, being particularly important in northern temperate-water oceans (*i.e.* Northeast Atlantic) (Sissewine & Mace, 2007). In 2004, over 5.6 million tonnes of deep-water species were reported worldwide; of these, 2.4 million (43%) were blue ling (*Molva dypterygia*) catches obtained in the northeastern Atlantic along with other species, including Greenland halibut (*Reinhardtius hippoglossoides*), ling (*Molva molva*), northern prawn (*Pandalus borealis*), roundnose grenadier (*Coryphaenoides rupestris*), and others. The southeastern Pacific and southwestern Atlantic, where most Latin American countries fish, contributed no more than 3% of global deepwater catches in 2004. Nevertheless, over 350,000 tonnes of total catches were reported that year of Patagonian toothfish (*Disostichus eleginoides*), Patagonian grenadier (*Macruronus magellanicus*), the pink cusk-eel (*Genypterus blacodes*), and southern blue whiting (*Micromesistius*

australis) (Sisewine & Mace, 2007), all resources from temperate waters. Notwithstanding these official figures, considerable deepwater fishing activity has been reported off Latin America, particularly at lower latitudes and in tropical waters such as the Brazil slope area (Perez *et al.*, 2003), the Nazca Ridge (Parin *et al.*, 1997), and seamounts in the southeast Pacific Ocean and off the coast of Chile (Arana, 2003). Despite the lack of comprehensive and widely accessible information, these reports suggested that the Latin American fishery was also going deep.

These were the feelings that motivated the Latin American Association of Marine Sciences (ALICMAR) to promote the first workshop fully focused on compiling comprehensive studies on deep-sea fisheries off Latin American countries in 2007 during the XII COLACMAR (Latin American Congress of Marine Science) held in Florianópolis, Brazil. During the event, nine oral presentations by researchers from

New Zealand, Spain, Costa Rica, Brazil, Chile, and Uruguay offered a rich overview on the biology and fisheries of deepwater resources in Latin America, the eastern Atlantic, and seamounts around the world. A consensus emerged from the workshop participants that a thorough, perennial recording of this otherwise quite dispersed knowledge should be attempted in order to fully document and recognize Latin American deep-water fisheries, biology, and management.

A contemporary agreement celebrated between the Pontificia Universidad Católica de Valparaíso (Chile) and Universidade do Vale do Itajaí (Brazil) during the XII COLACMAR produced the appropriate collaborative environment to envisage a joint edition of a volume of the Latin American Journal of Aquatic Research (LAJAR) especially devoted to the publication of invited and fully peer-reviewed papers on Latin American deep-sea fisheries and resources. Editorial

Table 1. Main deep-water species dealt with in the papers published in this issue, by region and fishery status.

Tabla 1. Principales especies que son tratadas en el presente número de la revista, por región y situación pesquera de cada una de ellas.

Resources	Region			Status		
	Atlantic ocean	Pacific ocean	Seamounts elsewhere	Potential resource	Developing fishery	Exploited/overexploited
Fish						
Alfonsino	<i>Beryx splendens</i>					
Granadero	<i>Coryphaenoides delsolari</i>					
Patagonian toothfish	<i>Dissostichus eleginoides</i>					
Orange roughy	<i>Hoplostethus atlanticus</i>					
Tylefish	<i>Lopholatilus villarii</i>					
Monkfish	<i>Lophys gastrophysus</i>					
Argentine hake	<i>Merluccius hubbsi</i>					
Wreckfish	<i>Polyprion americanus</i>					
Brazilian codling	<i>Urophycis mystacea</i>					
Silver John dory	<i>Zenopsis conchifera</i>					
Crustaceans						
Giand red shrimp	<i>Aristaeomorpha foliacea</i>					
Scarlet shrimp	<i>Aristaeopsis edwardsiana</i>					
Alistado shrimp	<i>Aristeus antillensis</i>					
Golden crab	<i>Chaceon chilensis</i>					
Golden crab	<i>Chaceon fenneri</i>					
Red crab	<i>Chaceon notialis</i>					
Royal crab	<i>Chaceon ramosae</i>					
Red royal shrimp	<i>Haliporoides diomedea</i>					
Camellón shrimp	<i>Heterocarpus affinis</i>					
Camellito shrimp	<i>Heterocarpus vicarius</i>					
Fidel shrimp	<i>Solenocera agassizii</i>					
Molluscs						
Argentine shortfin squid	<i>Illex argentinus</i>					

efforts directed at contacting and enlisting/enrolling/recruiting as many contributors as possible from all regional countries resulted in a total of 20 articles that compile information on deep-water fisheries carried out between 2000 and 2008 off both the Pacific (11) and Atlantic (8) coasts of Latin America. The majority of the data presented originated from slope areas and seamounts within the EEZs of Brazil (8), Chile (7), Perú (2), and Costa Rica (1) as well as the high-seas (2). The studies span a variety of aspects of deep-sea fisheries including: (a) regional fishing development, (b) stock assessments and biological studies, (c) fishing management, and (d) biodiversity and conservation of deep Vulnerable Marine Ecosystems.

Detailed information about 22 potential, developing, and exploited/overexploited deep-sea resources has been made available by these papers, most of which (12) focus on shellfish stocks including several shrimps, four geryonid crabs, and one squid (Table 1). This fact adds particular interest to this volume: unlike other areas of the World Ocean where deep-sea fisheries have been demonstrated to concentrate largely on bony and cartilaginous fishes (see reviews in FAO, 2007), benthic and demersal invertebrates are comparatively more important in Latin American fisheries.

Not surprisingly, concerns about the sustainability of these fragile deep-water resources and their respective habitats have also emerged as a recurrent topic in this volume, as 45% of the reported species have already been revealed to be exploited or overexploited in the region despite their relatively recent fishing history (Table 1). Therefore, as the international community mobilizes research and diplomatic efforts to limit and regulate the economic exploitation of deep-sea environments in EEZs and on the high-seas by designing general agreements and recommendations (FAO, 2007) or establishing regional fishing management organizations (*i.e.* South Pacific Regional Fishing Management Organization; www.south.pacificrfmo.org), this volume is intended to contribute the necessary knowledge to promote the sustainable management of Latin American deep-water environments and their respective resources.

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