



## Cephalopods of Pacific Latin America



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### ABSTRACT

Cephalopod fisheries have experienced outstanding growth in Latin America during the last quarter century, increasing from 0.5% to 7% of total Latin American landings since 1990. Its waters account today for a third of world cephalopod catches, with about two-thirds of this total being landed by Latin American countries and the remainder by East Asian countries. The ommastrephid squids *Dosidicus gigas* and *Illex argentinus* have led catches worldwide, while *Doryteuthis gahi* is the most important loliginid. Mexico, Peru, Chile, Argentina and the Falkland Islands (Malvinas) account for 98% of landings in the region. Pacific waters account for 60% of cephalopod landings in Latin America. Mexico, Peru and Chile account for virtually all landings from the Pacific. This has been largely achieved through switching the targets of national fishing fleets to squid. There are a variety of directed fisheries for octopus, some of which raise concerns about sustainability. Most landings are exported to East Asia and Europe, but local cephalopod supply has increased. Aquaculture research on octopus in Chile is experiencing a mayor advance with international impact.

Cephalopod research in Latin America is progressing in response developments in the fishing industry, especially in Mexico, Peru, and Chile. Nevertheless, cephalopod consumption is still relatively low and fisheries in these countries all depend strongly on foreign markets. In the smaller countries of Central America, as well as Colombia and Ecuador, cephalopods remain negligible as a marine resource.

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### 1. Introduction

Historically cephalopods have rarely been important culturally. However, outstanding examples are octopuses depicted in pottery from a large span of time (XVIII–XI cent. BC) in Minoan Crete (Alberti, 2013). Octopuses are also depicted in seafood in mosaics from Imperial Rome (Capaldo and Moncharmont, 1989). A closer association between cephalopods and humankind is represented in the relationship between octopuses and Japanese ama divers depicted in *netsuke* miniature carvings and *shunga* woodblock prints from the Edo period (Bru, 2010). Today East Asian and Mediterranean countries still dominate cephalopod catches, commerce and consumption (Boyle and Rodhouse, 2005).

In pre-Columbian Latin America cephalopods were occasionally portrayed and examples include octopuses in cave paintings from Baja California (Viñas et al., 1984–1985), tentacled figures from bas-reliefs of the Manteño civilization at Manabi, Ecuador (Saville, 1907, 1910) and squid lenses used as mummy eyes at Arica, Chile (Rising, 1866). Probably the most outstanding cases are octopus represen-

tations in the Moche culture of northern coast of Peru, 100–800 AD. The gilded copper chest discovered at the tomb of the Old Lord of Sipan (Alva, 2009) (Fig. 1A) is probably the only known cephalopod representation in human history closely related to a ruler. Tentacle characters resembling octopus are also known in the pottery of this civilization (Fig. 1B).

Cephalopods are currently valued as a marine resource of high quality protein. Their fisheries have rapidly expanded worldwide in the last few decades and are one of the few marine resources that remain underexploited, and catches have continued to rise. This apparent abundance of cephalopods has been explained as a result of “fishing down the food web” (Pauly et al., 1998). Other suggested causes are depletion of stocks of groundfish and other predatory fishes, as well as global expansion of fisheries into new areas because of increased market demand (Boyle and Rodhouse, 2005; Pierce and Portela, 2014). Another potential factor relevant to expansion of cephalopod fisheries appears to be the ability of many squids to adapt readily to climate change, including expansion of oxygen minimum zones in the Pacific (Gilly et al., 2013; Stewart et al., 2014). Public interest in cephalopods has increased in the media in the recent years, mainly because of the search for the giant squid *Architeuthis*, but also in the USA in conjunction with a major, though apparently transient, range expansion of

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**Fig. 1.** (A) Funeral mask and pectorals of the Old Lord of Sipan, the large gilded copper volutes probably represent the eight arms of an octopus (Alva, 2009; courtesy of Royal Tombs of Sipan Museum, Lambayeque, Peru). (B) Mochica pottery depicting anthropomorphs with tentacles that likely represent octopus arms, northern Peru, AD 100–800 (courtesy of Larco Museum, Lima).

*Dosidicus gigas* between 2002 and 2010 that was accompanied by many strandings (Gilly, 2006).

Voss (1960, 1973, 1986) reviewed cephalopod fisheries in Latin America. He reported unimportant catches and poorly reported landing statistics with unidentified species fished with a variety of gears. He pointed out the unknown potential of these resources and the need for additional research. This picture did not change for several decades (Juanico, 1980; Arocha, 1989; Rocha and Vega, 2003). More recently, the Southwest Atlantic and the Southeast Pacific have become important for fisheries of abundant marketable species, particularly *Illex argentinus* and *D. gigas*, displacing the Northwest Pacific as the main squid-fishery region (Pierce and Portela, 2014). As a consequence, Latin America is a region where interest in these resources has advanced considerably. This paper describes the historical development of cephalopod fisheries, and their management, markets and aquaculture potential in Latin American countries with coasts on the Pacific Ocean. Recent reviews on squid resources of the Atlantic side of the continent have focused on the main squid resources, *I. argentinus* and *Doryteuthis gahi* (Arkhipkin et al., 2013; Rodhouse et al., 2013), and thus emphasize the southern region.

## 2. Fisheries of cephalopods in Latin America

Global fishery landings increased steadily until the mid-1980's, when they more or less stabilized around  $90 \times 10^6$  t per year. Cephalopods, however, are one of the few marine resources whose

landings have continued to increase since 1980, more than doubling since then to exceed  $4 \times 10^6$  t in 2006. Cephalopods now account for over 4% of all global landings (Fig. 2A; FAO, 2015). World cephalopod landings by country and by major species are reported in Pierce and Portela (2014).

Latin American fishery landings account roughly for a fifth of total global landings, although they show large annual, ENSO-related oscillations due to the prominence of Peruvian anchoveta catches, the largest single-species fishery in the world. Total landings for Latin America peaked at  $24 \times 10^6$  t in 1994 and then dropped to an annual average of about  $16 \times 10^6$  t over the last 10 years (Macchi et al., 2014). In sharp contrast, cephalopod landings in Latin American countries have experienced a dramatic increase over this period, rising from 0.5% to 7% of landings in 2012 (FAO, 2014), corresponding to  $125 \times 10^3$  t in 1990 to over one million t in 2006 and 2008 (Fig. 2B).

Since 1987, when catches of the ommastrephid squid *I. argentinus* reached twice those of the common Japanese squid *Todarodes pacificus*, the most squid landed to that time, squid fisheries in Latin American waters (FAO areas 31, 41, 77 and 87, without US landings) have accounted for more than a third of cephalopod catches worldwide (Fig. 3A). Following a crash in the *I. argentinus* fishery starting in 1999, jumbo squid *D. gigas* replaced it as the world's largest squid fishery by 2004. Together, these two species account for half of all ommastrephid catches worldwide in this century, and this squid family (Ommastrephidae) represents 61% of global cephalopod catches (FAO, 2014).

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