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SHORT COMMUNICATION

On the distribution of *Physalia physalis* (Hydrozoa: Physaliidae) in Chile

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Abstract New distribution records of the pleustonic siphonophore *Physalia physalis* Linnæus, 1758, are presented based on the record of several colonies washed ashore during January to June 2015 around the port of Caldera (27° S), Región de Atacama, northern Chile. The bright blue-purplish colonies of this species have unique morphological characteristics, which include a conspicuous sail-like, gas-filled pneumatophore, and thin, ribbon-like tentacles (cormidia). Although the colonies of this conspicuous "jellyfish" are widely known in the northern Chilean coasts associated with the El Niño Southern Oscillation Events, scientific records are scarce. This is the third and northernmost record of *P. physalis* in Chile, extending the previously known northern distribution record of this species in the country by about 890 km.

Keywords Jellyfish · Siphonophorae · El Niño · Southeastern pacific · Biodiversity · Atacama

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Introduction

Physalia physalis Linnæus, 1758, the Portuguese Man O'War or Blue Bottle, is the only pleustonic siphonophoran; this species is most recognizable by its almost transparent pneumatophore of bright bluish color; an air bladder developed from one of the polyps, which helps it to navigate and float in the surface of the sea (Iosilevskii and Weihs 2009). *Physalia physalis*, the first siphonophore to be formally described, is common in the tropical and subtropical regions of the world's oceans, usually found between 40° S and 55° N. The natural history, morphology, and biology of this species were studied in a fundamental work produced by Totton (1960). In Chile, this species was first cited by Molina (1788) as *Holoturia physalis*, without a specific distribution, and it was later recorded by Fagetti (1958) for Easter Island (27°07′ S; 109°22′ W) and by Moyano and Valdovinos (1984) and Brito (2002) for the continental Chilean coasts in Hueicolla (40°08′ S; 73°41′ W) La Unión, Region de los Rios, South-central Chile and from the province of San Antonio (33°17′ S to 33°55′ S), Región de Valparaíso, central Chile, respectively. Here we provide new records of this species for Chile, extending its current northern distribution in about 890 km from its previous range in San Antonio, central Chile.

Materials and methods

Sampling was carried out manually at beaches from Parque Nacional Pan de Azúcar (26°10′ S; 70°39′ W) to Puerto Viejo (27°20′ S; 70°56′ W), Región de Atacama, northern Chile, from October 2014 to September 2015 (Table 1). Fifty-five colonies were found stranded in protected bays (Fig. 2b and c) and seven colonies were found still alive washed ashore at Playa Rocas Negras (27°08′34″ S; 70°53′

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Table 1 Localities in the Region of Atacama, Chile, with the presence of colonies of *Physalia physalis*

Locality, coordinates	Number of specimens	Date
Parque Pan de Azucar (26° 10′ S; 70°39′ W)	1	January 21, 2015
Obispito (26° 44′ S; 70° 42′ W)	3	February 12, 2015
Aguas Verdes (26° 52′ S; 70° 49′ W)	1	February 12, 2015
Playa Rodillo (26° 58′ S; 70° 48′ W)	1	October 14, 2014
Playa Ramada (27° 00′ S; 70° 48′ W)	1	October 14, 2014
Playa Brava (27° 03′ S; 70° 48′ W)	4	February 12, 2015
Playa Copiapina (27° 03′ S; 70° 49′ W)	7	February 12, 2015
Playa Loreto (27° 04′ S; 70° 50′ W)	6	June 20, 2015
Calderilla (27° 05′ S; 70° 51′ W)	18	February 12, 2015
Bahía Inglesa (27° 06′ S; 70° 51′ W)	2	January 23, 2015
Rocas Negras (27° 08′ S; 70° 52′ W)	13	September 19, 2015
Bahía Cisne (27° 14′ S; 70° 56′ W)	3	January 23, 2015
Puerto Viejo (27° 20′ S; 70° 56′ W)	2	February 04, 2015

39″ W). The collection of specimens followed Totton (1960), and a few colonies were preserved in 96 % ethanol. A pair of representative colonies was deposited (unnumbered) in the collections of the Museo de la Pesca Artesanal in Caldera, Chile and in the Museo Paleontológico de Caldera (MPCCL 26102015A), Caldera, Chile.

Systematics

Order Siphonophorae Eschscholtz, 1829
Suborder Cystonectae Haeckel, 1887
Family Physaliidae Brandt, 1835
Genus *Physalia* Lamarck, 1801
Type species *Physalia pelagica* Lamarck, 1801 (by monotypy).

Remarks. The genus *Physalia* has a complex history, due in part to the highly variable morphology of its monotypic species, particularly in the cormidial elements. All of the 23 described species were synonymized with *Physalia physalis* by Totton (1960).

***Physalia physalis* (Linnæus, 1758)** (Figures 1A–C, 2A–C)

Holoturia physalis Linnæus, 1758: 657; Molina, 1782: 198. *Physalia arethusa* Agassiz, 1862: 335, pl. XXXV, fig. 1. *Physalia physalis* Lane, 1960: 158; Totton, 1960: 301, pl. IX, fig. 1; Kirkpatrick and Pugh, 1984: 26, fig. 5; Vera et al. 2004: 235, figs. 4, 5; Bardi & Marques, 2007: 426–430, figs. 1–36; Mapstone 2014: 10, figs. 4B, 7A–C. *Medusa utriculus* Gmelin, 1791: 3155. *Physalia utriculus* Gershwin et al. 2010: 79, figs. 4A–C. A more complete chresonymy of this species can be found in Gershwin et al. (2010)

Description. Colonies with triangular, asymmetric pneumatophore, formed by a thin pale-bluish to purple-bluish and almost transparent membrane, of 22 to 85 mm in length and a maximum diameter of 29 mm in examined specimens (Fig. 1a). Pneumatophore with a longitudinal wrinkled crest, of bluish-green and carmine color at upper region (Fig. 2a). Apical pore in the aboral region of the colony. Oral and main zones of colony separated by basal internode, a gap region with no polyps. Main zone more developed than oral zone. Polymorphic organisms organized in cormidia, budding off directly from the inferior region of pneumatophore. Oral zone with up to five cormidia and protozooid. Main zone with up to seven cormidia. The cormidia of the main zone is formed by zooid groups with different composition and development in different organisms; with a reduced group consisting of gastrozooids; a primary tripartite group consisting of gastrozooid, tentacle with dactylozooid and gonodendron; a lateral group trifid, budding off from branches of the primary tripartite group; and secondary basal buds, trifid, budding off from base of reduced primary-tripartite or lateral groups. The cormidia of oral zone without primary tripartite-group. The colonies are dioecious, the gonodendra is branched; branches with male or female gonophores. Sub-terminal branch end with elongated vestigial nectophore and elongated tubular gonopalpon. Terminal branch end with nectophore and gonopalpon. Gonophores ovoid. Elongated nectophores with widened distal end, bell-shaped. Gonopalpons concentrated at distal ends of the sub-terminal and terminal branches. Elongated gastrozooids (Fig. 1c) distally widening from median region, with sub-terminal constriction and mouth at distal end, either free or associated with dactylozooid. Elongated dactylozooid with thinner distal end. Larger dactylozooids linked to tentacles along its whole length, smaller ones partially and basally linked to tentacles (Fig. 1a). Tentacles compressed, with smaller tentacles sinuous along its length; larger tentacles curly from median to distal region. Nematocyst batteries concentrated in thicker regions of

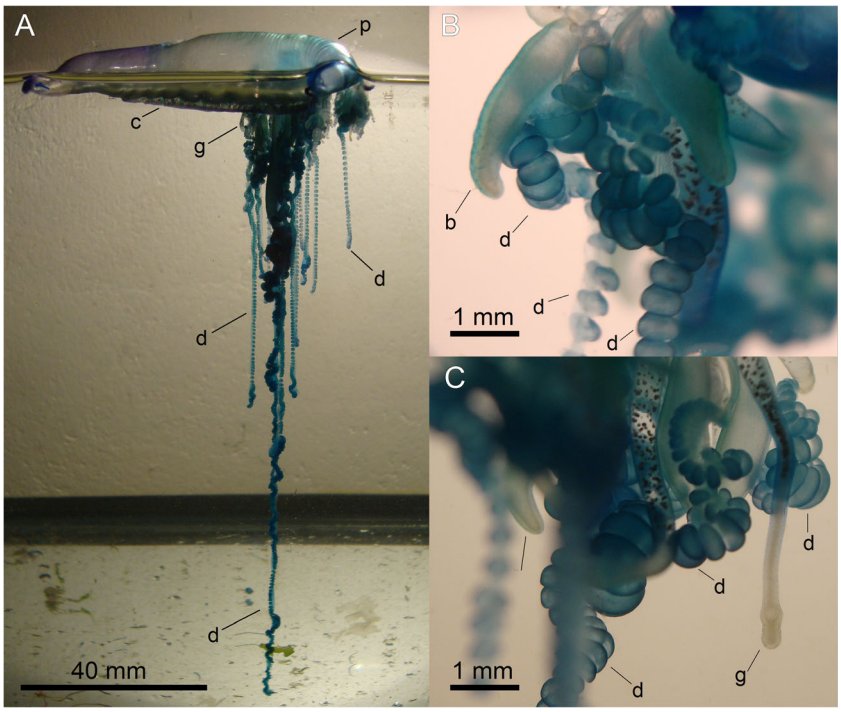

Fig. 1 *Physalia physalis* (Linnæus, 1758), collected at Playa Rocas Negras (27°08′34″ S; 70°53′39″ W), Caldera, Chile (MPCCL 26102015A). **a**; specimen photographed alive in an aquarium, note the crest positioned at its side; **b**: detail of cormidia of same specimen showing dactylozooids and bract; **c**: detail of cormidia of same specimen showing dactylozooids and gastrozooid. Abbreviations, b: bract, c: crest of pneumatophore, d: dactyozooid, g: gastrozooid

tentacles, spirally arranged (After Bardi and Marques 2007).

Remarks. The disposition of the crest on the pneumatophore, in relation to the cormidia hanging from it, allows the recognition of two groups of colonies in the examined specimens, which can behave differently in the wind. This dimorphism has already been described in British specimens by Kirkpatrick and Pugh (1984). The pneumatophore, covered by transparent mucus in live specimens, is the only recognizable structure which remains for some time after being stranded on the beach; it can respond to external stimuli by changing its width/height ratio and also by modifying the crest dimensions, often lowering it to a lateral position (see Fig. 1a).

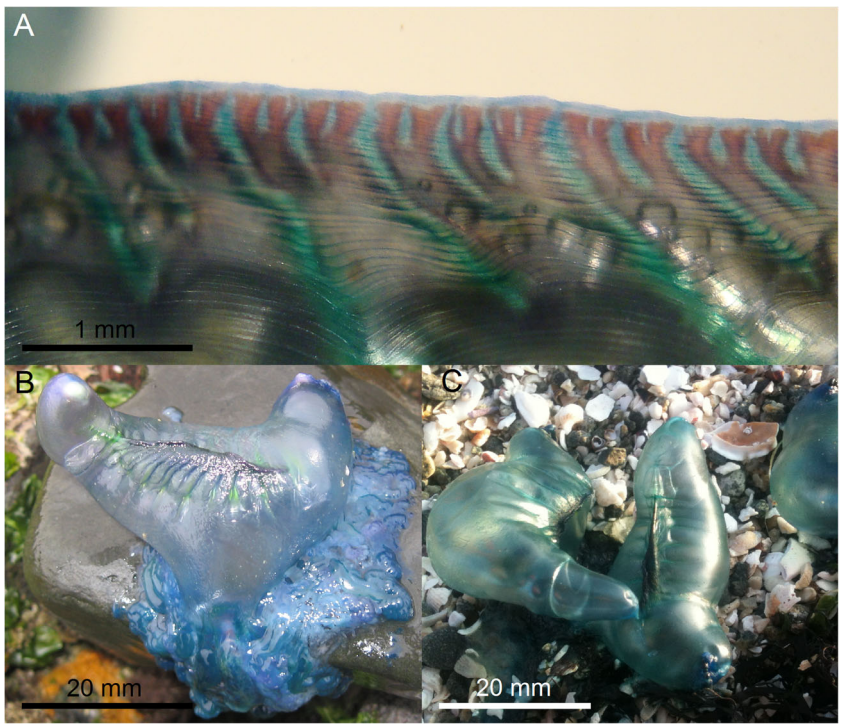

Fig. 2 *Physalia physalis* (Linnæus, 1758), collected at Playa Rocas Negras (27°08′34″ S; 70°53′39″ W), Caldera, Chile (MPCCL 26102015A). **a**; detail of crest, showing the colored pattern on its border; **b**: bright blue colony, washed ashore specimen, Playa Ramada (27° 00′ S; 70° 48′ W); **c**: washed ashore specimen, Calderilla beach (27° 05′ S; 70° 51′ W)

Discussion

Physalia physalis is one of the 55 species of Siphonophora recorded from Chile (Palma 2010). This species is locally and temporally abundant; however, its abundance is strongly related to El Niño Southern Oscillation (ENSO) events, which have caused massive blooms of jellyfishes and associated fauna in the coasts of northern and central Chile (Oliva et al. 2010; Araya and Araya 2015). In this study, colonies of *Physalia physalis* were found stranded on numerous beaches along the coasts of the Región de Atacama, in northern Chile (Table 1). This species is clearly venomous; its thin tentacles (dactylozooids) are capable of discharging thousands of cnidae, which depend on mechanical and chemical stimuli, producing acute envenoming in humans and even death caused by vasomotor dysfunction and collapse (Lane and Dodge 1958). The venom of the Blue Bottle is as toxic as cobra *Naja* spp venom; the stings from their nematocysts are powerful enough to penetrate tough surgical gloves and they can remain active even when air-dried (Lane 1960; Pierce 2006; Haddad et al. 2013). In Chile however, apart from the attacks cited by Brito (2002) for San Antonio and Cartagena, no further incidents have been documented in the literature.

The abundance and recognition of this species in Chilean waters is thus highly important; its morphology, which includes an erectile sailing crest that helps them navigate, along with the changes in water currents by recent ENSO events, may have facilitated the aggregation of *P. physalis* in coastal waters along the Southeastern Pacific. These aggregations, however, never reach the densities of the blooms of those of the true jellyfish *Chrysaora plocamia* (Lesson, 1830) in northern Chile. Even when this species has been cited on two occasions as inhabiting the waters around Easter Island, it was not found there in a recent study on the siphonophores of the area (Palma 1999). It is thus also possible that its distribution may be linked to certain specific factors, including surface water temperature and salinity.

The geographical distribution of this cosmopolitan species is mostly restricted to warm waters, and thus it is difficult for it to reach higher latitudes. The single record from Macquarie Island, south-eastern Tasmania (54°30′ S; Merilees 1970) is the most extreme, and the southernmost record of this species (Gershwin et al. 2010), probably drifting there as a result of the influx of warmer water from the Tasman Sea. Records of this species, as *Fragata portuguesa* or *Carabela portuguesa* as it is locally known in the region, from Arica (18° S) to Ancud (45° S) in northern and southern Chile, respectively, have been acknowledged in the Chilean media including newspapers and television, however we could not obtain actual specimens from northern or southern localities to examine and confirm or corroborate such claims. The mostly scant records of this conspicuous siphonophore in the eastern Pacific may be a reflection of sampling effort or because there is a paucity of researchers or specialists working in the field, especially in northern Chile. There is also a lack of specimens deposited in local museums; they are not even represented in the collections of the Museo Nacional de Historia Natural (MNHNCL), in Santiago, Chile (Jorge Pérez-Schultheiss pers. comm.). In conclusion, the new records of *Physalia physalis* extend its previously known geographical range in Chile by about 890 km northwards. As indicated by one of the reviewers of this manuscript, a recently report for this species, presented at the 35th Congreso de Ciencias del Mar, Coquimbo, Chile (Canepa and Palma 2015), has also given additional records for Easter Island and the Juan Fernández Archipelago and new records for the coasts of Chile from Playa Chinchorro (18°27′ S) to the Bahía de Ancud (41°52′ S), suggesting also that they may have arrived at Perú and Ecuador, according to the news media.

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