

Penshell *Atrina oldroydii* (Bivalvia: Pinnidae) in the Gulf of California

El callo de hacha, *Atrina oldroydii* (Bivalvia: Pinnidae) en el Golfo de California

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ABSTRACT

The genus *Atrina* is a cosmopolitan bivalve mollusk, but the distribution of the different species is probably dependent on ecological characteristics, such as specific habitats. The northern limit of the geographic distribution of the penshell *Atrina* (*S.*) *oldroydii* Dall, 1901 is the Panamic Province in Bahía Magdalena, Baja California Sur, even though it is from San Pedro, California. In this work, we report a new penshell bank of *A. oldroydii* on muddy substrate at 30-m depth, about 29-km, from Bahía de Kino, Sonora Mexico, at 3 to 14 organisms per m² with maximum length of 319 mm. We concluded that the species encompasses a new record, not previously reported to the inner waters of the Gulf of California.

Key words: *Atrina oldroydii*, Gulf of California, new record, Pinnidae.

RESUMEN

Dentro de los moluscos bivalvos, el género *Atrina* es considerado cosmopolita y la distribución de sus diferentes especies probablemente depende de características ecológicas específicas. La distribución del callo de hacha, *Atrina* (*S.*) *oldroydii* Dall 1901, se encuentra dentro de la frontera norteña de la provincia Panámica, hasta Bahía Magdalena en la costa Pacífico de Baja California Sur, aunque también se ha registrado en San Pedro, California. En este trabajo se reporta un nuevo banco de *A. oldroydii* en sustrato fangoso a profundidades de 30 m, a una distancia de 29 km de Bahía de Kino, Sonora México, con densidades de 3 a 14 organismos por m², y longitud máxima de 319 mm. Se considera un nuevo registro de *A. oldroydii* dentro del Golfo de California, no reportado previamente.

Palabras clave: *Atrina oldroydii*, Golfo de California, nuevo registro, Pinnidae.

The Gulf of California is an ecosystem of great marine-mollusk diversity in temperate latitudes. Many studies of these marine-faunal invertebrates have included their distribution, abundance, species composition, and records of new species (Hendrickx *et al.*, 2007; Zamorano *et al.*, 2007). In Mexico, the mollusk penshell is of great economic importance along the coasts of the Baja California Peninsula, Sonora, and Sinaloa.

Keen (1971), Poutiers (1995), and Coan *et al.* (2000) describe the importance of the Pinnidae family, including their biology, ecology, and the geographic distribution of the species. *Pinna rugosa* (Sowerby, 1835) (Fig. 1A) from the Gulf of California, to the south of Panama. *Atrina* (*Servatrina*) *tuberculosa* (Sowerby, 1835) (Fig. 1B), also known as *Pinna tuberculosa*, is found from the Gulf of California to Panama and *Atrina* (*S.*) *maura* (Sowerby, 1835) (Fig. 1D) from the Baja California Peninsula, including the Gulf of California, to the south of Peru. *Atrina* (*S.*) *texta* Hertlein, Hanna & Strong, 1943, is in San Pedro, California; and from Banco Gorda, Baja California Sur, Mexico, to the Galapagos Islands (Coan *et al.*, 2000).

The species *Atrina* (*S.*) *oldroydii* Dall, 1901 (Fig. 1C) is from the outer coast of Baja California Sur, Mexico at Bahía Magdalena on the Pacific coast of the Baja California Peninsula (Keen, 1971). For *A. oldroydii*, Morán-Angulo and Valdez-Pineda (2009) published a new geographic record along the coast of Sinaloa and northern Nayarit. The purpose of our work is to report the distribution of *A. oldroydii* in the Gulf of California off Sonora, Mexico.

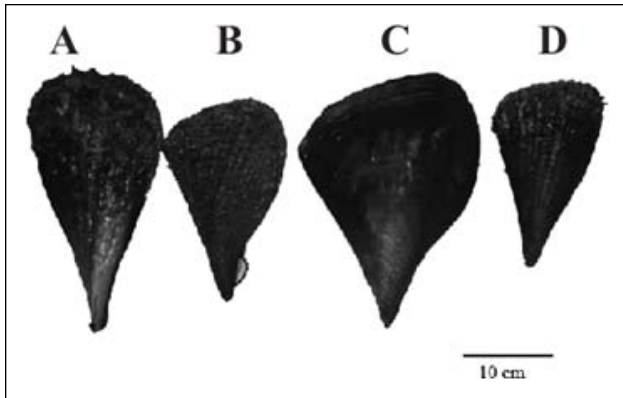


Figure 1A-D. Panshell images of live specimens of A) *Pinna rugosa*, B) *Atrina tuberculosa*, C) *Atrina oldroydii*, and D) *Atrina maura* from the coast of Bahía Kino, Sonora, Mexico.

In the last quarter of 2009, shrimp vessels collected *A. oldroydii* during their fishing activities off the coast of Sonora, which information led hookah divers (HDs) to search the bank. After they found the specimens, the extractions began. When we found the empty shells discarded on beaches of Bahía Kino, we called the HDs to help us reach the penshell bank. On board a small boat in November 2009, divers helped us make dives at four different sites. On the bottom, they collected the animals by hand and counted the number in about one m² at each dive site. We used a Garmin GPS map76F to determine the locations of the sampling sites. On board we recorded the total length of each organism ($n = 141$). Live animals ($n = 41$) were transported to the laboratory to record their biometrics, including the total fresh weight and the adductor muscle weight. In addition, we determined the gender of the specimens by gonad coloration, with the male gonads being whitish gray and purple orange for females. We recorded the type of sediment at each site. The taxonomic classification was according to Keen (1971) and Coan *et al.* (2000) and the species description was taken from Morán-Angulo and Valdez-Pineda (2009). In addition, for comparison with the other commercial penshells, we include images of the species off the coast of Bahía Kino.

The comparison of the penshell specimens demonstrated the differences, showing that *A. oldroydii* is morphologically different from the other species and that it is the larger of the *Atrina* mollusks of the Gulf of California (Fig. 1A-D). According to Coan and Scott (1997) and Coan *et al.* (2000), its classification is Class: Bivalvia; Superfamily: Pinnoidea Leach, 1819; Family: Pinnidae Leach, 1819; Genus: *Atrina* J. E. Gray, 1842; Subgenus *Servatrina*, Iredale, 1939; Species: *oldroydii* Dall, 1901. Its description is elongate, shell partially nacreous with two muscle scars well-separated. It is triangular, with a groove down the middle inside, which divides the nacreous portion into two lobes. The shell is grayish-brown, smooth, slender, having concentric ring sculptures in the middle portion. The geographic locations of the collection sites

are in Table 1. The density of the specimens in the substrate was 3 to 14 animals per m². The minimum total length of the collected organisms was 220 mm, with a maximum of 319 mm; of these 44% were between 280 and 299 mm (Fig. 2A). The weight of the adductor muscles was 35 to 95 g, with a range of 65 to 75 g for 27% of the sample (Fig. 2B). The gender of the animals in the sample was 39% females and 24% males, with 37% undifferentiated. The gender ratio was 6:4 female:male. The temperature and salinity in situ were 19 °C and 35 psu. Including all the three distinct geographic sites of the records of *A. oldroydii*, the distribution of the species is along the coast of Baja California, Gulf of California, and south in Mexican Pacific waters along the coasts of Sinaloa and Nayarit (Fig. 3).

Species of the Pinnidae Family live in bays and coastal lagoons on bottoms of sand and limestone at depths of 0.5 to 15 m. The most exploited in the Mexican Pacific are the *Pinna rugosa* and *Atrina maura* species (Ahumada-Sempoal *et al.*, 2002) but there are few studies on these species. Work has been done on their reproduction and population structure in the exploited banks (Ahumada-Sempoal *et al.*, 2002; Ángel-Pérez *et al.*, 2007), but studies of the abundance and distribution along the coasts are scarce. The genus *Atrina* is a cosmopolitan, bivalve mollusk, but the distribution of different species is probably dependent on ecological characteristics, such as specific habitats at depths where it is inaccessible. *Atrina* and *Pinna* species exists as metapopulations comprised of small groups of patches of individuals (Idris, 2008) and little is known on the penshell population in Pacific Mexican waters.

After Keen (1971), *A. oldroydii* was reported along the Pacific coast of the Baja California Peninsula as far south as Bahía Magdalena, but its recent location along the southern coast of Sinaloa and northern Nayarit, México was important and indicated that their range was farther south along the Mexican coast (Morán-Angulo & Valdez-Pineda, 2009). We now report a new location of a penshell bank of *A. oldroydii*, within the Gulf of California, about 29-km off Bahía Kino, Sonora, Mexico. The maximum distance between the sampled sites was about four kilometers, indicating that there must be other banks of the same species along the coast of the gulf. The species was not found before because of the dis-

Table 1. Sampling locations of the penshell, *Atrina oldroydii*, in the Gulf of California.

New location 21 November 2009	Depth of sample (m)	Collected penshells	Total Count/m ²
28°33'78"N, 112°02'31"W	22	25	14
28°34'21"N, 112°02'69"W	25	25	10
28°34'45"N, 112°02'63"W	28	25	3
28°35'13"N, 112°01'60"W	26	25	10

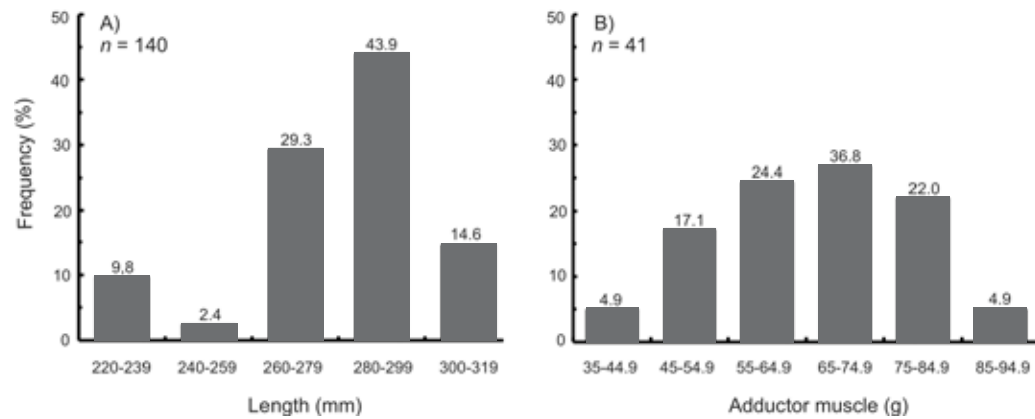


Figure 2A-B. A) Total shell length, B) weight of the adductor muscle of the penshell *Atrina oldroydii* from the Gulf of California, Mexico.

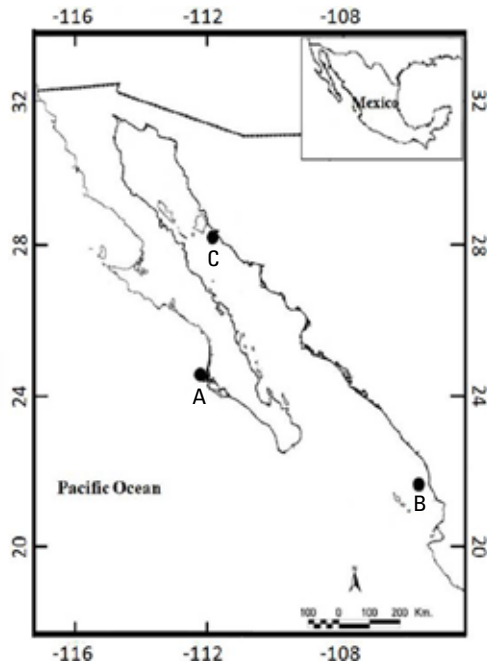


Figure 3. Previous record of geographic limit of the distribution of *Atrina oldroydii* off the coast of the Baja California Peninsula at Bahía Magdalena, Keen (1971) (A). Record of *A. oldroydii* from Morán-Angulo and Valdez-Pineda (2009) off the southern coast of Sinaloa and northern Nayarit, Mexico (B). Our report indicating the *A. oldroydii* new location in the Gulf of California (C).

tance from the coast and they were at more than 30-m depth. The *A. oldroydii* banks constitute a special muddy habitat far from the coast, as are the banks reported in Sinaloa and Nayarit. All the three distinct geographic sites of the records of *A. oldroydii* for the species are along the coast of Baja California, Gulf of California, and southern Sinaloa and Nayarit coasts. At present, there

are no studies of its biology and ecology at these banks in the Gulf of California, nor any management or conservational plans (Cinti *et al.*, 2010).

Our data indicated a maximum length not recorded before, but it will be necessary to analyze more samples to confirm the structure of the species. *Atrina oldroydii* in Nayarit and Sinaloa had shorter lengths, as reported by Morán-Angulo and Valdez-Pineda (2009). Because of the discrete distribution of the species along the Mexican coast, we need more studies on the total abundance, population dynamics, and management plans.

Off the coast of Sonora, the commercial penshell species *Atrina tuberculosa* and *Pinna rugosa*, and to lesser extent *A. maura*, are the exploited species south of Canal del Infiernillo near Isla Tiburón (Moreno *et al.*, 2005). At present, *A. oldroydii* is the principal focus of extraction by hookah divers in Bahía de Kino. Because of this, we recommend further research to delimit the species distribution, biology, ecology, and aquaculture potential. Presently, penshells of the Gulf of California, including *A. oldroydii*, could be vulnerable to uncontrolled human exploitation because as reported, they are found in local discrete banks, probably along most of the Mexican Pacific coasts. Most important is the need for the regulation of extraction methods for the security of the fishermen.

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