

ARGONAUTA NODOSA SOLANDER, 1786 (CEPHALOPODA: ARGONAUTIDAE) IN ARGENTINE WATERS

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Abstract *Argonauta nodosa* Solander, 1786 is formally recorded off Puerto Quequén, in the south of Buenos Aires province, Argentina. Despite some scanty dubious citations in early local malacological literature this is the first record from Argentine temperate waters. Two females were collected from the stomach contents of the blue shark *Prionace glauca* and one empty egg case was recovered by fishermen nets. Two other lots were found in museum collections. Morphological data on the animal, shell and beaks are provided. Some remarks are pointed out about the presence of this worldwide tropical species.

Key words Cephalopoda, Argonauta, south-western Atlantic.

INTRODUCTION

Stomach contents provide information about feeding behaviour and preferences of individual predators. However, the possibility exists of using the predators as samplers of the ecosystem to reveal aspects of the distribution and biology of uncommon groups such as Argonautids.

Argonautids are a curious group of octopuses which develop a distinctive thin shell. This shell is produced only by females, basically to protect the eggs. In addition, flotation and protection of the adult is also provided. Voss & Toll (1998) cited seven valid living species grouped in the genus *Argonauta*, the only one existing in the family Argonautidae.

The probable presence of *A. nodosa* in Argentine waters (Brunetti, 1995; sometimes as *A. tuberculata* Lamarck, i.e. Carcelles, 1944) is a recurring issue in malacological literature from South America. However, most of the records are based on old citations without sampling or collection support.

In this paper we formally record for the first time the presence of *Argonauta nodosa* Solander, 1786 in Argentine waters, from direct and indirect documental sources. In addition several morphological measurements, including those of the beaks, are provided to facilitate comparison with material from other localities.

MATERIALS AND METHODS

Two complete females of *Argonauta nodosa*, including parts of broken shells and eggs, were recovered from the stomach of a female Blue Shark, *Prionace glauca* (Linnaeus, 1758) caught by fishermen off Puerto Quequén (38°37'S–58°50'W) in Buenos Aires province. The stomach was immediately dissected and frozen. Together with *A. nodosa*, one specimen of *Engraulis anchoita* Hubbs & Marini, 1935 and one of *Galeorhinus galeus* Linnaeus, 1758 were recognized in the stomach contents of this shark, a fact suggesting non specific or opportunistic feeding habits. The total length and weight of the predator were 2200 mm and 52 kg respectively.

Additional material available for examination included one shell collected by the boat "Eusonia" at its fishing area also off Puerto Quequén, and two lots of empty shells from the invertebrate collection of the Museo Argentino de Ciencias Naturales (MACN).

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TABLE 1

Measurements for *Argonauta nodosa* female specimens. The symbols denote: *=the material was not in good condition to be measured, +=distal arm tip suckers severely damaged and #= shortened by predator action. Acronyms follow Roper & Voss (1983) and O'Shea (1999).

MACN #34812		Specimen 1	Specimen 2
ML		83	88
TL		304	300
MW		52	45
HW		26	24
HdL		26	22
AL1	R/L	211 / 174	170 / 110
AL2	R/L	98 / 128	167 / 178
AL3	R/L	211 / 212	121 / 132
AL4	R/L	180 / 200	170 / 146
WDA		37.1	20.7
WDB	R/L	20.3/16.3	15.3/ 14.6
WDC	R/L	15/13.9	17.2/19.3
WDD	R/L	17.8/ 14.3	21/19.4
WDE		16.7	19
ASC1	R/L	23+/18+	25+/17+
ASC2	R/L	32#/33#	48+/26+
ASC3	R/L	73/112	28+/23+
ASC4	R/L	86/83	17+/18#
ASn1	R	3.4	*
ASn2	R	3.6	2.7
ASn3	R	3.7	*
ASn4	R	3.9	L 2.7
GiLC	inner	12	11
GiLC	outer	12	12
Fful		49	58
FFL		28	44*
ED		14	13.4

RESULTS

Argonauta nodosa Solander in Lightfoot, 1786 Figs 1a–b; 2a–f.

Argonauta nodosa Solander in Lightfoot, 1786:96.

Material examined MACN 17825, East of English Bank, Mar del Plata, in 18.3–36.6 m; MACN 9877, Mar del Plata, Buenos Aires; MACN 34781, Puerto Quequén, Buenos Aires province; all empty shells; MACN 34812, 2 complete females.

Remarks The first mention of the name was attributed to Solander; however the author of the Catalogue where it was published was Lightfoot (according to Rehder, 1967). Most of the classical measurements were taken following the general description tips published by Roper & Voss, 1983. Since both complete females came from stomach contents, it was impossible to take measurements on some of the parts, although the general morphometrics agree with those pointed out by O'Shea (1999). In addition the

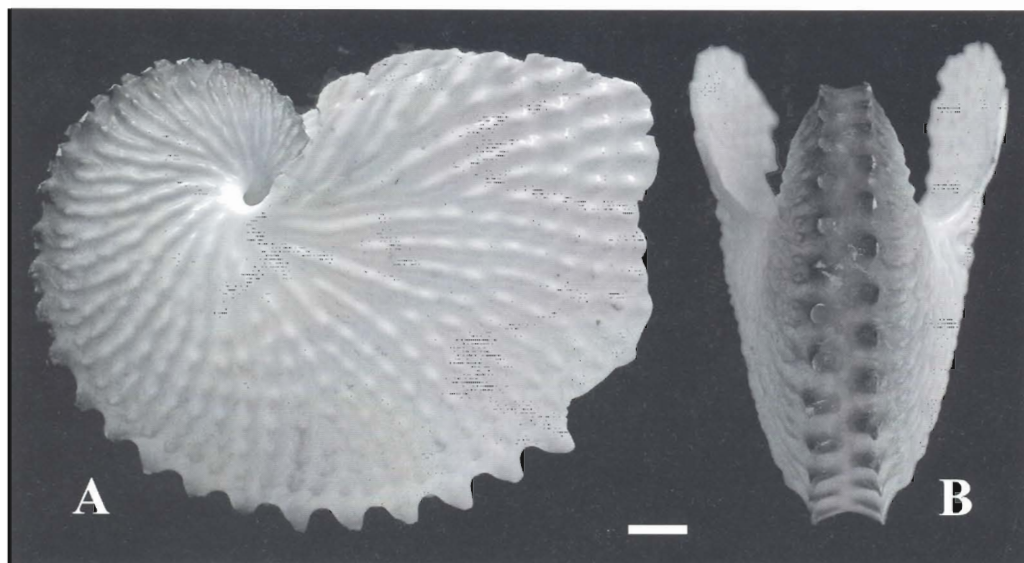


Fig. 1 *Argonauta nodosa* Solander, 1786 **A** MACN 34781, egg case lateral view **B** posterior view of the same shell. Scale bar = 1 cm.

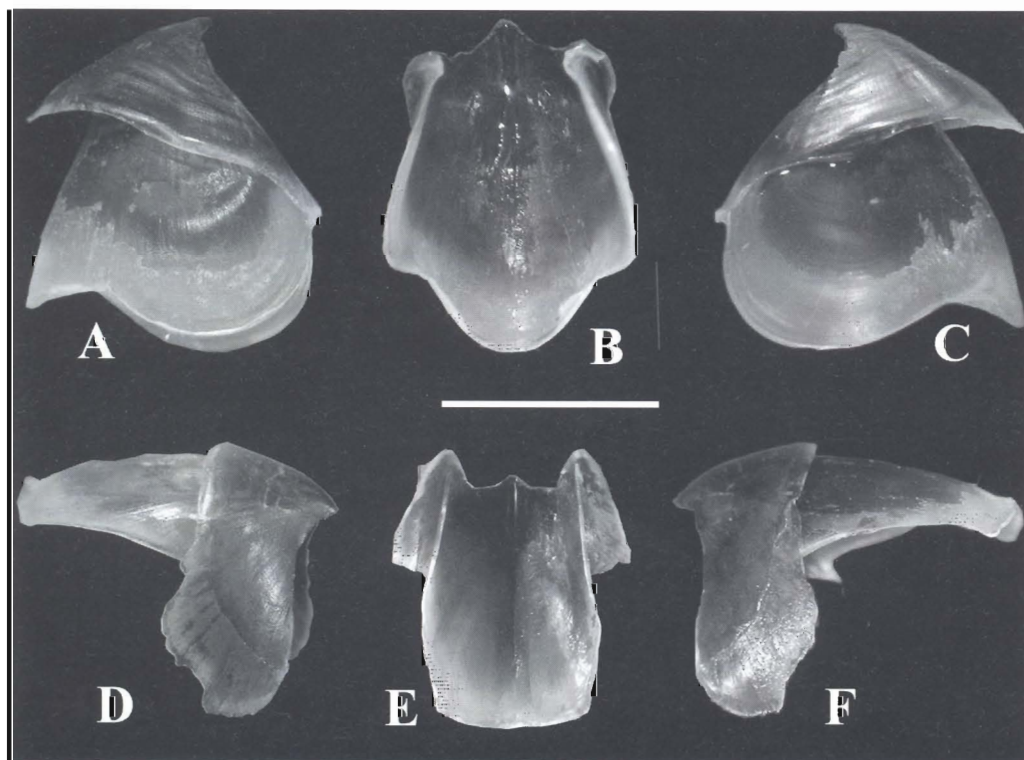


Fig. 2 *Argonauta nodosa* Solander, 1786. MACN 34812, beaks of a female specimen **A-C** three views of the upper mandible **D-F** three views of the lower mandible. Scale bar = 1 cm.

TABLE 2

Measurements of the beaks. Terminology follows O'Shea (1999). ¹Refers to the complete specimen in g.

Beak measures	MACN 34812	
	Specimen 1	Specimen 2
Lower Beak		
Width	15.6	16.0
Length	15.05	15.4
Height	10.7	10.3
Hood length	7	6.2
Wing length	12	11.9
Upper beak		
Width	11.3	11.7
Length	15.2	14.4
Height	13.5	14.2
Hood length	9.7	8.9
Total Weight ¹	89.6	45.8

morphology of both beaks is illustrated (Fig. 2a–f) and quantified (Table 2). They match perfectly well with previous illustrations (Change, 1999; O'Shea, 1999, among others). Data on total weight of both specimens are provided with the aim of exploring its relationship with the size of the beak, a ratio that could possibly be used for future inferences of stomach contents (Clarke, 1962).

DISCUSSION

Argonauta species seem to be predated by several different animals all around the world. Ortiz-Corps *et al.* (1995) confirmed the presence of *A. argo* and *A. hians* in the gut contents of the dolphin fish, *Coryphaena hippurus* from Puerto Rico, in the Caribbean. Many sharks are known to include these cephalopods as part of their diet. Smale (1991) and Dunning *et al.* (1993) recorded *Sphyrna zygaena* (Linnaeus, 1758), *Galeocerdo cuvieri* (Peron & Le Sueur, 1822) and *Prionace glauca* as predators. Also, Dunning (1993) and Clarke *et al.* (1996) recorded *P. glauca* as a common predator of Argonautids. However, the authors did not identify the species.

The blue shark *P. glauca* is one of the most abundant pelagic species with a virtually circumglobal distribution in tropical and temperate seas (Stevens, 1973). In the northern hemisphere, during the warmer season, the geographic range is extended northwards in the Pacific and the Atlantic oceans (Le Brasseur, 1964; Templeman, 1963). The southwestern Atlantic populations that usually live in Brazilian warmer waters could easily go farther south along the Argentine coast. In fact, they are captured in oceanic waters off Buenos Aires province in Argentina and the marine coast of Uruguay (Marín *et al.*, 1998).

Stevens (1990) mentioned speeds of 2.1 to 7.5 km day⁻¹ for an adult specimen of *Prionace glauca* based on tagging calculations. Therefore one adult shark probably will need around two months to travel the distance of 500 km from the southernmost marine point of Uruguay (~35°S–55°W) to Puerto Quequén area. Even if we take into account the telemetry experiment demonstrated by Casey (1985, in Stevens, 1990) that showed a speed of 37 km day⁻¹, it would be necessary around two weeks to cover the same

distance. Due to the fine preservation of the octopuses in the stomach we have no doubt about the real presence of *Argonauta nodosa* in Argentine waters.

Most of the records of *A. nodosa* are from warm waters, and the samples here studied suggest that Puerto Quequén, mostly a temperate locality, is the southernmost record of its real range. O'Shea (1999) mentioned records from the Indo-West Pacific, southern Japan to southern Africa, Australia and Polynesia. Chile was mentioned by Nesis (1987: 327) as a doubtful record. Rios (1994) and Haimovici & Andriquetto (1986) collected specimens from Rio Grande do Sul state (Brazil) and Uruguay, albeit only in summer. Despite the latter citations Cheng (1998) ranges this species only from the Indian and Pacific Oceans in the Southern Hemisphere.

Together with *Tamoya haplonema* (Cnidaria: Cubozoa) (Pastorino, 2001) and several other fishes (Tamini, in prep.) collected in the same area and during the same seasonal period, *A. nodosa* confirms the existence of climatic phenomena that allow the presence of warm water species in temperate regions.

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