

First documented occurrence of the starry toadfish *Arothron firmamentum* (Teleostei: Tetraodontidae) in the south-west Atlantic

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The first documented record of the Indo-west Pacific pufferfish *Arothron firmamentum* was reported off Mar del Plata, Argentina at a depth of ~45 m and is the first occurrence of the starry toadfish in American Atlantic waters. Some morphological and biological characteristics are given for the two specimens caught. Different explanations of how the two pufferfish specimens arrived in south Atlantic waters are discussed.

Species of *Arothron* are widely distributed throughout the tropical regions of the Indo-west Pacific (Matsuura, 1994). Because the taxonomy of the group is still under consideration, it is unclear how many species are represented worldwide (Gomon et al., 1994). Although most species usually inhabit coastal waters, around coral reefs, *Arothron firmamentum* (Temminck & Schlegel, 1850) is a relatively deep-water species, frequently caught at a depth range of 30 to 80 m (Hardy, 1980). The species is known from the southern part of Japan, the south China Sea, New Zealand and Australia (Hardy, 1980; Masuda et al., 1984; Gomon et al., 1994), and has recently been found at Cape St Francis and Sea Point in Cape Town, South Africa (Heemstra, 1995), and also from New Caledonia (Matsuura & Tyler, 1997).

On 3 April 2000 two specimens of starry toadfish ('hoshifugu' in Japanese) *Arothron firmamentum*, a species not previously recorded in American Atlantic waters, were collected by a commercial trawler off Mar del Plata (38°20'S 56°30'W) at a depth of about 45 m on the Argentine continental shelf. The Argentinian records constitute the first report of the species in the western Atlantic coast.

The specimens were first fixed in formalin and subsequently transferred to alcohol and deposited in the fish collection of the Instituto Nacional de Investigación y Desarrollo Pesquero as INIDEP 713 and INIDEP 714. Proportional measurements expressed as per cent of standard length (SL) were taken using dial calipers. Fin ray and vertebrae counts were made by means of X-ray photographs. Measurements and colour description were made from fresh specimens.

One of the specimens was eviscerated in order to investigate the diet and to establish sex and maturity. Small fragments of tissue were removed from the centre of each gonad for histology, and stained with Harris's haematoxylin and eosin. The distinguishing characteristics of the specimens caught are: the head and the body covered with prickles, except on posterior of caudal peduncle, around mouth, eye, gill opening and on fin bases; some random variation in prickles covering and density on caudal peduncle was found. INIDEP 714 specimen showed more spines than those observed in the other specimen (Figure 1). Each nostril with two fleshy flaps formed by bifurcation of a single base; many small circular light pale spots on

head and body on a distinctive dark brown ground colour on lateral and dorsal parts of head and body; ventral region becoming pale. Lateral lines on both specimens indistinct.

Morphometric and meristic data are listed in Table 1 and correspond to those reported in the literature for this species. Although Matsuura (1994) pointed out that some external characters and proportional measurements are not useful for separating the species of *Arothron* since specimens are subject to be distorted in preservative, here morphometric characteristics were taken as complementary information for the specimens collected off Mar del Plata.

Microscopic examination of food remains adhering to the digestive tube walls (stomach and intestine measured 132 cm length overall) revealed the presence of Cnidaria (Hydrozoa), Nematodes, Polychaetes, Pelecypods (Nuculidae and Pectinidae), Gastropods (Olividae), Echinoderms (Asteroidea and Ophiuroidea), Briozoa (Membraniporidae) and Crustaceans (Brachyura). The dissected specimen was histologically sexed as a maturing female with few small previtellogenic oocytes scattered among vitellogenic oocytes.

In the present study, the finding of two antitropical Indo-west Pacific Tetraodontid specimens of *Arothron firmamentum* long distance from their usual area of occurrence is of much interest because a different transport mechanism of fish fauna with tropical affinities to the south-west Atlantic should be addressed.

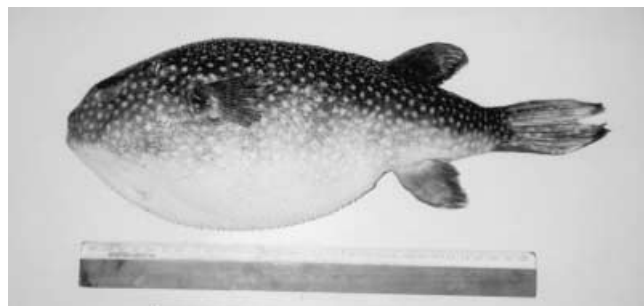
The finding of tropical or subtropical fish species in coastal waters off northern Argentina, especially as a southern range extension of Brazilian ichthyofauna, has been considered as occasional reports at the end of summer and beginning of autumn. These sporadic occurrences have been attributed to the incursion of warm neritic waters to the Argentine continental shelf (Díaz de Astarloa & Figueroa, 1995).

More recently findings extended the distribution range of *A. firmamentum* to South Africa, substantially further west from the typical area of occurrence. Specimens of starry toadfish were recorded in Asvoel Point, Cannon Rocks, Kenton, and Cape St Francis in South Africa (Heemstra, 1995).

The occurrence of *A. firmamentum* on the southernmost eastern Atlantic might be explained by the injection of Indian water into the south-eastern Atlantic via the Agulhas Current (AC) tending to add heat and salt to the South Atlantic. The

Table 1. Proportional measurements (expressed in per cent of standard length (SL), or as otherwise indicated) and counts of two specimens of *Arothron firmamentum* reported for the first time in the western Atlantic (38°20'S 56°30'W) at 45 m depth in April 2000, and the corresponding range values of other specimens gathered from the literature. *, taken on the right side.

	INIDEP 713 (female) 298 mm SL	INIDEP 714 (female) 310 mm SL	Hardy 45– 335 mm SL	Masuda et al. 350 mm SL	Goman et al. 430 mm TL	Matsuura & Tachikawa 128–166 mm SL	Matsuura & Tyler 242 mm SL
Total length (TL)	125.5	125.8	120.0*				
Head length (HL)	32.9	34.8	27.8–32.2				
Head depth	38.6	36.4					
Eye diameter (in % of HL)	13.9	14.6	13.7–17.2				
Snout length (in % of HL)	28.5	31.3	28.5–35.7				
Postorbital length	20.1	19.0					
Predorsal length	72.8	73.9	71.4–76.9				
Preal length	74.5	74.8	71.4–76.9				
Snout to anus	69.5	67.7	66.7–71.4				
Bony interorbital width	16.4	16.1					
Body depth	39.6	37.7					
Body width	21.8	20.3	17.8–29.4				
Longest dorsal ray	23.1	20.3	15.9–20.0				
Longest anal ray	21.1	19.7	15.6–18.9				
Caudal fin length	24.8	26.8	23.8–29.4				
Pectoral fin length	16.1	14.2*	12.8–15.9				
Caudal peduncle depth	10.7	10.6	8.3–9.2				
Caudal peduncle length	15.8	14.2	13.9–18.2				
Dorsal fin base length	10.7	11.3	9.4–12.2				
Anal fin base length	9.4	10.0	9.0–11.6				
Dorsal fin rays	14	14	13–15 (usually 14)	14	13–15	13–14	16
Anal fin rays	13	14	13–15 (usually 14)	13–14	13–15	14	14
Pectoral fin rays	15	15	15–17 (usually 16)	16	15–17	16	16
Caudal fin rays	11	11	11		11		
Vertebrae	20	20	20				

**Figure 1.** *Arothron firmamentum*, INIDEP 714, 310 mm standard length (SL), off Mar del Plata, Argentina.

AC is one of the strongest currents of the world oceans. It flows westward along the continental shelf of the southern rim of Africa.

The unusual occurrence of the Indo-west Pacific *Arothron firmamentum* in the south-west Atlantic might be related as a trans-oceanic migration from the eastern South Atlantic via the Agulhas leakage. Similar transport mechanisms have also been proposed for other fish species (Barletta et al., 1989). Other possible mechanisms of widespread distribution of the starry toadfish might be explained either by carriage via ballast water or by escape from local aquaria.

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