

**NORTH-EASTERNMOST RECORD OF *HALOSAURUS OVENII* (ACTINOPTERYGII:
NOTACANTHIFORMES: HALOSAURIDAE) IN THE MEDITERRANEAN SEA,
WITH NOTES ON ITS BIOLOGY**

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Abstract. A single adult female specimen of *Halosaurus ovenii* Johnson, 1864 was captured by trammel nets at a depth of about 200 m off the coast of Arbatax (Sardinia, Italy) in early April 2007. Macroscopic and microscopic analysis of the gonad showed a postspawning ovary. This is the fourth documented capture of this fish in the Mediterranean Sea, representing the north-easternmost record for this species in this geographic area. Furthermore, the present specimen was fished at the shallowest depth ever recorded before.

Keywords: *Halosaurus ovenii*, new record, Mediterranean, Sardinia

According to Froese and Pauly (2008), 10 species belong to the genus *Halosaurus* Johnson, 1864 (Notacanthiformes: Halosauridae), 3 of which commonly occur in the eastern Atlantic: *H. guentheri* Goode et Bean, 1896; *H. johnsonianus* Vaillant, 1888; and *H. ovenii* Johnson, 1864. The latter species is a benthopelagic fish that lives at bathyal depths ranging from 440 to 1700 m (Sulak 1986). It is an amphiatlantic fish commonly present off Madeira, the Canaries, the Azores and the western African coast from Morocco to South Africa (Sulak 1990), but it was also recorded off the coast of Portugal (Costa and Reiner 1978). In the western Atlantic its geographical distribution is well documented from the Caribbean and the Gulf of Mexico, and off the Lesser Antilles (Sulak 1990, Smith 2002). This fish is extremely rare in the Mediterranean Sea, where Golani et al. (2002) considered it as an exotic species. Its first record in this basin was reported by Dieuzeide (1963) from off the Habibas Islands (Algeria, western Mediterranean) where, in 1960, a single specimen was captured at 550 m depth. Cau and Deiana (1979) documented the occurrence of this species off Capo Teulada (Sardinia, Italy, central western Mediterranean) at 620 m depth. Finally, D'Onghia et al. (2004) captured one

specimen (229 mm TL) off the Balearic Islands, at 2800 m depth, the deepest record for this species. The capture of another specimen of *H. ovenii* off the eastern coast of Sardinia represented a noteworthy opportunity to collect additional information on its geographical distribution and biology.

On 3 April 2007, one adult specimen of *H. ovenii* was captured by trammel nets 1.5 miles off the port of Arbatax (Sardinia, central western Mediterranean, lat 39°57.6'N, long 09°44.3'E) on a muddy bottom at a depth of about 200 m (Fig. 1). The fish was photographed (Fig. 2), frozen at –20°C, and in the laboratory it was identified to species according to Sulak (1986).

Its stomach contents were weighed, examined, and then stored in 70% ethanol. After sex determination (female), the maturity stage of the ovary was assessed macroscopically according to Holden and Raitt (1974), and then the gonad was fixed in 5% buffered formalin for subsequent histological analysis. Afterwards, the ovary was dehydrated in an ascending ethanol series, embedded in resin, and semi-thin sections of 3 mm were stained with sodium iodoeosine and toluidine blue following Dominici's method modified for methacrylate (Mazzi 1977). The iden-

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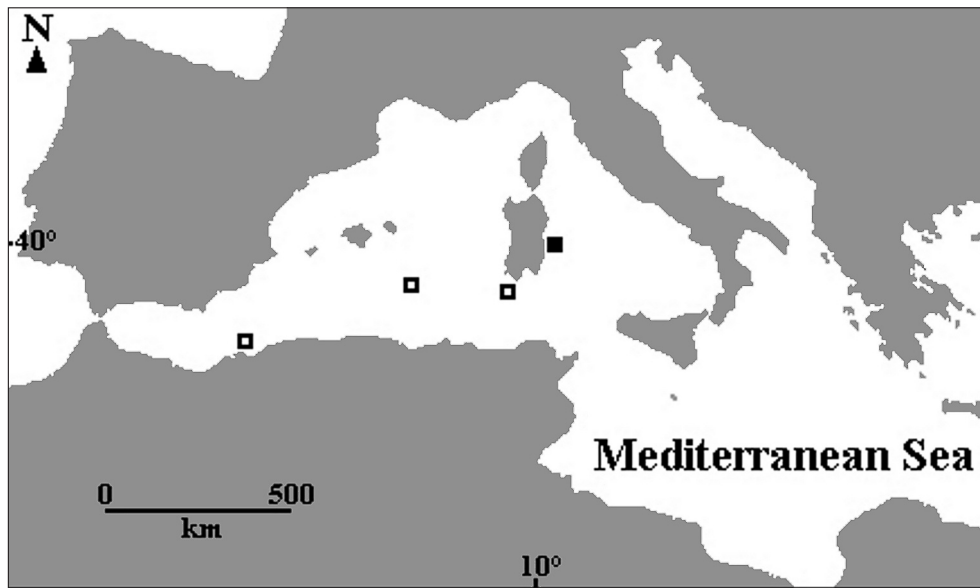


Fig. 1. Map of records of *Halosaurus ovenii* in the Mediterranean. Black square = presently described record; hollow squares = previous records

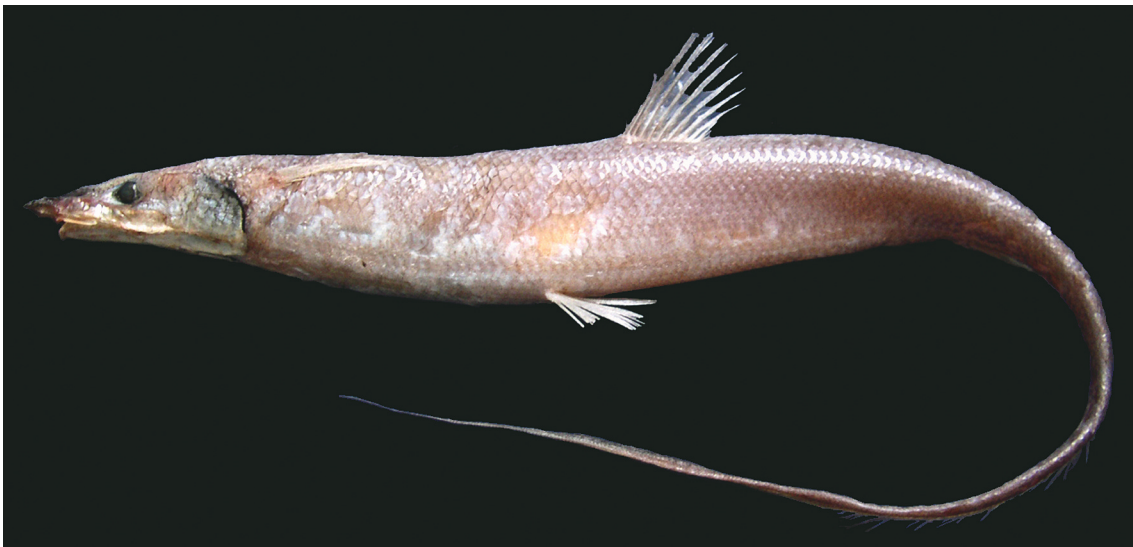


Fig. 2. *Halosaurus ovenii*, DSZ-04/07, 470 mm TL, Sardinia, Western Mediterranean, 200 m depth

tification of the oocyte developmental stages was carried out using an optical microscope, according to the scale proposed by Forberg (1982). Gonadic maturity stages were determined on the basis of the relative abundance of oocytes cells in the more advanced stage of development. The diameter of nucleated oocytes was measured by means of a graduated ocular.

Body surface, mouth, gills, body cavity and all internal organs were examined for metazoan parasites. Fresh scrapings of the organs were also observed microscopically for protozoan parasites. Finally, the fish was deposited in the ichthyological collection of the Department of Animal Science at the University of Sassari (registration code DSZ-04/07).

The fish was a female of 470 mm total length and 92.9 g total weight. Morphometric and meristic characters of the

present specimen and of those formerly reported from the Mediterranean are given in Table 1. The ovary appeared flaccid and whitish in colour, with many visible eggs. It was located just after the liver, composed by 2 distinct lobes originating proximally at about 1/5 of its length and extending posteriorly up to 3/4 of the body cavity. Macroscopic analysis revealed that it was at a post-spawning stage (stage 7 of Holden and Raitt scale). Subsequent histological analysis showed the presence of few mature oocytes [translucent (T), mean diameter $940 \pm 39.74 \mu\text{m}$, ripe egg stage by Forberg (1982)]; atresic oocytes (ATR); and post-ovulatory follicles (POF) (Fig. 3). The stomach and intestine contained only remains of organic matter and neither protozoan nor metazoan parasites were detected.

Halosaurus ovenii was first captured in the Mediterranean Sea only in 1960 (Dieuzeide 1963). This

Table 1
Morphometric and meristic data of *Halosaurus ovenii* specimens recorded in the Mediterranean Sea

Character	This study	Dieuzeide (1963)	Cau and Deiana (1979)	
Morphometric [mm]	Total length [TL]	470	—	520
	Gnathoproctal length	21	—	—
	Body height	35	1/14 TL	38
	Head length [HL]	56	1/8 TL	62.5
	Snout length	23	—	—
	Predorsal length	142	—	157
	Preanal length	225	—	—
	Eye diameter length [ED]	9.2–9.5	1/5 HL	13.3
	Eye diameter height	6.5–6.7	—	8.0
	Interorbital width	4.7	1/2 ED	—
	Meristic	Dorsal fin rays	I+10	I+10
Anal fin rays		>190	191	152
Pectoral fin rays		I+14	I+10	I+12
Ventral fin rays		I+7–8	I+9	I+9
Gill rakers 1st arch		12 (9+3)	—	—
Lateral line scales anterior to anus		66–67	—	—
Pyloric caeca		11	12	11

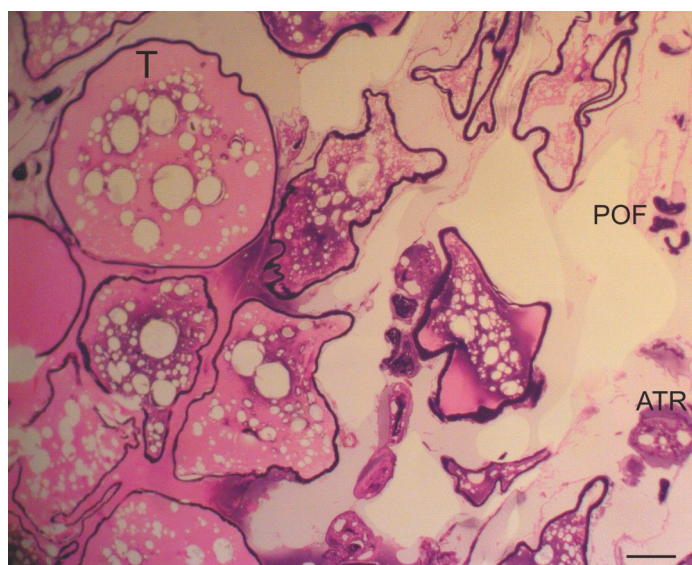


Fig. 3. Histological stage of *Halosaurus ovenii* ovary: translucent oocyte (T), post-ovulatory follicle (POF) and atretic oocyte (ATR); scale bar = 250 μ m

late record probably led Quignard and Tomasini (2000) to consider it as a recent migrant and not just a rare species in this geographical area. In any case, the present capture confirms its presence also in the central-western part of the basin and corresponds to its north-easternmost occurrence in the Mediterranean. As the present specimen was fished at the shallowest depth ever recorded before (i.e., about 200 m), this new record shows an extremely wide bathymetric range for this species, i.e., from 200 m down to 2800 m (D'Onghia et al. 2004). The female examined appeared at a post-spawning stage, in accordance with the observations reported by Cau and Deiana (1979) for

another *H. ovenii* specimen captured in the same period of the year. The presence of POFs in the gonadic tissue was a further confirmation that the ovary was quiescent (Cinquetti and Rinaldi 1987, Yoneda et al. 1998).

The specimen examined was totally free of parasites. There are few reports of parasites from members of the family Halosauridae, the only ones are from *Aldrovandia oleosa* Sulak, 1977 (cf. Sulak 1977) and *Halosauropsis macrochir* (Günther, 1878) (cf. Klimpel et al. 2001 and references therein, Klimpel et al. 2008), and no parasite had been reported from *Halosaurus* spp. Moreover, Boxshall (1998), in a broad study on host specificity

in copepod parasites of deep-sea fishes, observed that copepods had failed to colonise *Halosaurus* spp. from the North Atlantic, in spite of their relative abundance in deep sea habitat. The absence of parasites in the examined host (although limited to a single specimen) seems to confirm some drawback in the success of parasite on this genus, notwithstanding these fish inhabit the bathyal grounds, where the diversity of parasites is relatively high (Marcogliese 2002, Klimpel et al. 2006). Finally, a further mechanism that could explain the absence of parasites is the enemy release hypothesis (ERH). It points out that introduced species usually invade new areas without their natural parasites or they lose them in the new habitat (Colautti et al. 2004). This will suggest that *H. ovenii* should be considered as exotic to the Mediterranean Sea and/or that the examined host was caught at a shallower depth of the natural range of the species. But caution should be considered in the uncritical acceptance of ERH, as recently reported by Pais et al. (2007, 2008) and Merella et al. (2008), for Atlantic and Lessepsian migrants from the same geographical area.

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