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Occurrences of *Dalophis boulengeri* (Teleostei, Ophichthidae) off Northern Namibia

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ABSTRACT. – From the boundary waters between Angola and Namibia occurrences of 3 juvenile and 2 larval *Dalophis boulengeri* are documented. They occurred twelve, respectively two degrees of latitude farther south than earlier literature records. On the basis of these records and advanced hydrographical knowledge it is concluded that the reproduction of *D. boulengeri* is confined to warm waters between the Cape Verde Frontal Zone in the north and the Angola-Benguela Frontal Zone in the south. Leptocephali of this species may become expatriated by poleward currents beyond the adult range.

KEYWORDS: *Dalophis boulengeri*, adults, leptocephali; reproductive range, Angola, Namibia, Mauritania; frontal zones; larval transport.

Introduction

The tropical East Atlantic coastal snake eel *Dalophis boulengeri* (BLACHE, CADENAT & STAUCH 1970) can be very abundant in estuaries, but occurs in the marine habitat, too. It is a mud-burrowing species, leaving the sediment only at night (BLACHE & BAUCHOT 1972; LÉVÊQUE *et al.* 1990). Adults are said to be distributed from Mauritania in the north to the mouth of the Congo River, Angola (LÉVÊQUE *et al.* 1990; LEIBY 1990). From Fishbase (www.fishbase.org/occurrences/pointdata, respectively /OccurrencesList), as well as BAUCHOT *et al.* (1993) can be extracted that “Mauritania” refers to a single finding in the Baie de Lévrier, and “Angola” to the Cabinda area (unless LEIBY has implicitly used those larval occurrences discussed below). There exist several records for the area from Cape Verde to the mouth of the Congo River, but adults are undocumented from southern Mauritania. A further reference in Fishbase “native in the Benguela Current, from LEIBY (1990)” is not backed by LEIBY’s original paper. No documented records of adult *D. boulengeri* could be traced by us from south of the Congo River, although the occurrence there seems beyond doubt, since BLACHE (1977: Fig. 78d) depicted numerous occurrences of leptocephali from the Gulf of Guinea to 17° S, which is close to the border between Angola and Namibia (17° 14’ S). BLACHE’s mentioned figure suggests enhanced frequencies for the area 0 to 12° S.

The species has so far not been listed in faunistic inventories of Namibia (LLORIS 1986; BIANCHI *et al.* 1993; PENRITH 1976, 1978), but JOHN *et al.* (2004) mentioned a catch of two leptocephali off Namibia at approximately 20° S. Catches of leptocephali of this species have also been listed for off Mauritania (PALOMERA & FORTUÑO 1981) and Mauritania/Morocco up to 28° N (STRANG, in www.fishbase.org/OccurrencesList).

Methods and results

In April - May 2004 (cruise "Alexander v. Humboldt", AHAB-08, unpublished data) we have sampled 13 bottom stations (van Veen grab and dredge, 9 of them during daytime) on the SE-Atlantic shelf between 15 and 17° S, and 51 plankton hauls by a multiple-closing net (MCN) from midshelf to 08° E between 15 and 23° S. We refer furthermore to larval catches from the plankton survey by RV "Poseidon" in 1999 (51 plankton hauls 1.5° N to 20.5° S; SCHMIDT *et al.* 2000), and the Angolan part of a zonal transect along 11.5° S by RV "Meteor" in 1994 (21 hauls, midshelf to 1° W; JOHN & ZELCK 1998). Both latter surveys were also made during austral autumn by MCN. All station work included CTD casts.

The mentioned bottom samples accidentally brought up three juvenile *D. bouleengeri*, see Table 1. Bottom-near temperatures, salinities and oxygen contents at these three stations were 13.4 - 14.9 °C; S = 35.3 - 35.5 and O₂ = 0.12 - 0.78 ml/l.

Identification of the juveniles, exemplified by Figs 1 and 2, was based on the ventral position of the gill openings, existence of a tiny rudiment only of the pectoral fin, insertion of the dorsal fin at 17 % of SL, preanal length of 46 % of SL, dorsal and anal fins low and located in furrows, and a hard, pointed, finless tail tip.

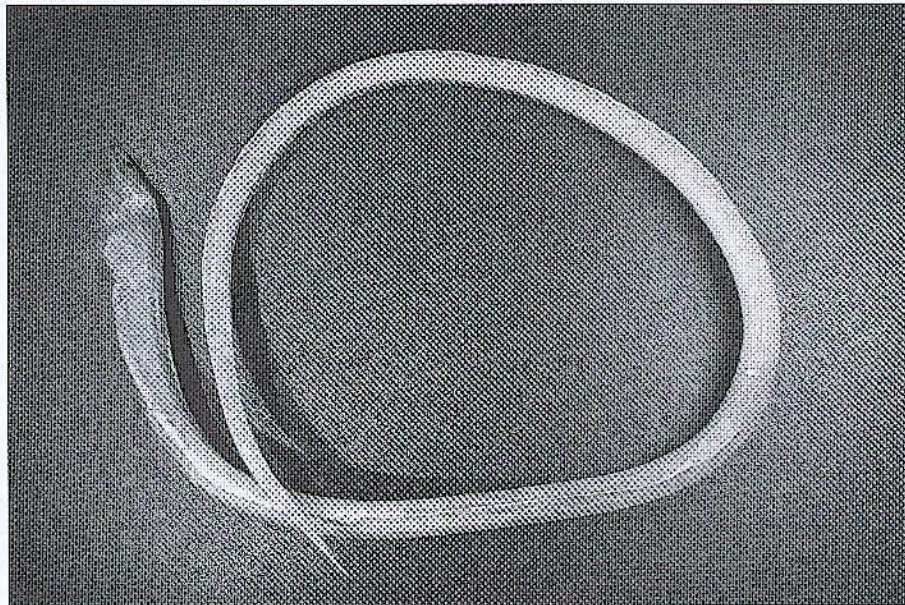


Fig. 1. *Dalophis bouleengeri* 187 mm SL shown from left (head) and ventral side.

The specimen of approximately 265 mm SL was damaged. Table 1 lists additionally the catch data of nine larval *D. boulengeri* (identified after BLACHE 1977: 239-244) deposited in Zoologisches Museum Hamburg (ZMH).

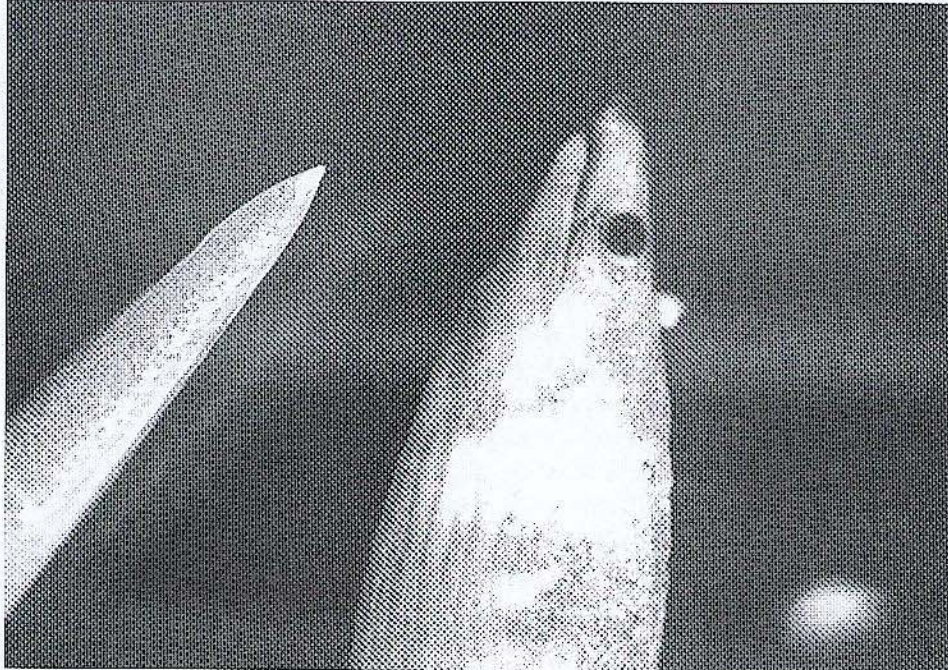


Fig. 2. Head and tail-tip of the same specimen as in Fig. 1

Table 1. Specimens of *Dalophis boulengeri* in the collections of Zoological Museum Hamburg. ZMH-numbers refer to the Atlantic fish collection. Prefixes 335 refer to the larval fish collection. J = juvenile, L = leptocephalus.

Cruise	Sample type	Sample no.	Collection label	Stage	Length SL (mm)	Latitude	Longitude	Date ddmmyy	Depth (m)
off Namibia									
Poseidon 250	MCN	47/4 (a)	335-47/4a1	L	41	19°16.4'S	11°20.3'E	240499	25-50
Poseidon 250	MCN	47/4 (a)	335-47/4a2	L	30	19°16.4'S	11°20.3'E	240499	25-50
AHAB-08	van Veen	BE-01	ZMH-9525	J	187	18°23.1'S	11°55.3'E	120504	42
off Angola									
AHAB-08	van Veen	BE-06	ZMH-9524	J	249	17°00.1'S	11°41.7'E	130504	29
AHAB-08	van Veen	BE-07	ZMH-9523	J	ca. 265	16°58.5'S	11°31.1'E	130504	105
Meteor 28	MCN	57/4 (a)	335-57/4a	L	120	11°40.2'S	10°59.9'E	050594	25-50
Meteor 28	MCN	57/5 (i)	335-57/5i	L	85	11°40.2'S	10°59.9'E	050594	0-25
Meteor 28	MCN	56/3 (b)	335-56/3b	L	116	11°20.0'S	10°00.0'E	020594	50-100
Meteor 28	MCN	56/4 (c)	335-56/4c	L	131	11°20.0'S	10°00.0'E	020594	25-50
Poseidon 250	MCN	21/5 (b)	335-21/5b	L	116	08°59.6'S	08°01.4'E	080499	0-25
Poseidon 250	MCN	15/2 (e)	335-15/2e	L	110	06°54.2'S	09°00.0'E	040499	100-150
Poseidon 250	MCN	14/4 (h)	335-14/4h	L	82	06°19.0'S	07°48.0'E	030499	25-50

Discussion

The catches of all 3 juveniles (south to 18° 23' S) and of 2 of the leptocephali (at 19° 16' S) are so far the southernmost records for this species. These two leptocephali, however, were caught after an intrusion of the warm Angola Current (AC) into Namibian waters, with a space- and time scale large enough to be classified as a Benguela Niño (see MOHRHOLZ *et al.* 2004). Leptocephali of *D. bouleengeri* had not been caught during the intense Spanish larval surveys off Namibia (OLIVAR & FORTUÑO 1991: nine surveys, all seasons, 321 hauls). We did not catch these leptocephali during AHAB-08, either.

We assume that the occurrence of these “teleneritic” larvae in Namibian waters may have been only exceptional, and restricted to the Angola Current intrusion. Such intrusions were fairly common in the late 1990's (HAGEN *et al.* 2001), and could subsequently be traced by us from positive SSTAs for austral autumns 2000 – 2003 (www.iridl.ldeo.columbia.edu/Monthly). No such intrusion occurred during AHAB-08 in 2004, when the Angola-Benguela Frontal Zone (ABFZ, separating warm AC-water from the cooler Benguela Upwelling and Benguela Current by 2 – 3 degrees of latitude) was located at its “normal” position at about 17° S nearshore (see *e.g.* MEEUWIS & LUTJEHARMS 1990). The majority of the Spanish surveys also coincided with “normal” conditions, one comparatively warm autumn survey (for details see OLIVAR & BARANGÉ 1990) can be classified as a quiescent upwelling, but not as a Benguela Niño.

The occurrences of the juveniles coincided with the ABFZs temporary as well as “normal” position, and we believe that this frontal system limits the distribution and particularly reproduction of this tropical species polewards. This occurs as well in the analogous, but much broader Cape Verde Frontal Zone (CVFZ) which separates always the shallow waters of Baie de Lévrier (21° N) and Banc d'Arguin, seasonally also Mauritanian offshore waters, from the cooler Canary upwelling system (KLEIN 1992; and literature therein). The centre of the CVFZ, when defined by water masses, has at the African continental slope a mean position at about 19° N. On basis of surface temperature, its mean position changes seasonally between 12 and 20° N (SMED 1982). In light of the many preceding warm years, the occurrence of immature specimens within the ABFZ may be somewhat extreme by some two to three degrees of latitude, and it is questionable whether these specimens might have reached maturity at all in the relatively cool bottom water.

We conclude that the general adult distribution of *D. bouleengeri* comprises the above mentioned shallow bank areas off Mauritania, albeit less likely the cool Mauritanian upwelling proper, where nearshore winter temperatures drop down to 15 °C (SMED 1982). These banks are covered by warm, highly saline water cascading down the continental slope (PETERS 1976). The cascading water probably seeds leptocephali into the poleward slope undercurrent, thus explaining the occurrences of leptocephali to 28° N, but also the teleconnection with the continuous distribution of the species farther south. We assume this range to reach from approximately Port St. Louis (16° N), where the estuary does not cool down in winter, to at least 15° S, which is generally the northernmost boundary of the ABFZ. The gap in literature records for adults between the Congo River and 15° S is more likely a consequence of lacking adequate research effort (and catching method) for that area than any effect of climatic change.

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