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Rare occurrence of Reinhardt's cranch squid *Liocranchia reinhardti* (Cephalopod: Cranchiidae) from southeastern Arabian Sea

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Short Communication

Abstract

Single individual of the rare cranchiid squid *Liocranchia reinhardti* belonging to the Cranchiidae family was caught in a bottom trawl operated at 80 m in southeastern Arabian Sea. The morphometric measurements and indices of the specimen are provided. Statolith microstructure analysis revealed that the *L. reinhardti* with 118 mm dorsal mantle length (DML) had an age of 71 days with growth rate of 1.66 mm DML/day.

Keywords*: Cranchiid squid, glass squid, Arabian Sea, Statolith, mesopelagic*

Introduction

Cranchiids are one among the members of numerous squids in epipelagic and mesopelagic waters of open ocean (Voss, 1980). The cranchiids comes under Cranchiidae family commonly known as glass squid due to their translucent appearance and having large coelomic cavities filled with neutrally buoyant ammoniacal fluid of low density (Denton *et al.,* 1969). They are distributed worldwide, from the Subarctic to the Antarctic and all species of this family exhibit an ontogenic descent; as maturation occurs in deep waters down to 2000 m (Diekmann *et al.,* 2002). Although, cranchiid squid represent no interest to commercial fisheries, they are preyed up on by the beaked whales (Santos *et al.,* 2001), sperm whales (West *et al.,* 2009) and Indo-pacific sailfishes (Varghese *et al.,* 2013). All species of this family are characterised by a thin walled mantle, often semi gelatinous, and also by the permanent fusion of the mantle with the funnel locking-cartilage as well as with the head in the nuchal region (Diekmann *et al.,* 2002). The family contains two subfamilies, Cranchiinae and Taoninae, with more than 60 species in 13 genera (Diekmann *et al.,* 2002). The subfamily Cranchiinae is represented by two species under single genus *Liocranchia*.

Liocranchia reinhardti is reported to have a cosmopolitan distribution in all tropical and temperate seas (Silas, 1968). It is distributed in tropical and subtropical waters of the world from surface to 1200 m (Voss, 1980) while *Liocranchia valdiviae* is a deep water (non-migrator) member of this genus in the

tropical waters of the Indo-Pacific region (Nesis, 1982; Young, 1978). *L. reinhardti* is also reported as one of the fast-growing squids in the epipelagic waters of tropical Atlantic (Arkhipkin, 1996) and is considered as one of the mesopelagic boundary species (Bower, 1999). Earlier Silas (1968); Aravindakshan and Sakthivel (1973) and Piatkowski and Welsch (1991) reported the occurrence of *L. reinhardti* from Arabian Sea.

In last few decades, studies on distribution and abundance of deep sea cephalopods from Arabian Sea are few. According to IUCN red list *L. reinhardti* is assessed as 'Least Concern' because it has a wide geographic distribution and inhabits deep-water, making it less susceptible to human impact. It is also not targeted by fisheries and is unlikely to be so in the future. However, more research is still needed on its ecology and biology (Barratt and Allcock, 2014). Because of their deep distribution and oceanic habitat, adult specimens of cranchiid squids rarely have been captured along with other commercially important squids that are caught in shallow waters.

In the present paper we report the record of a single specimen of *L. reinhardti* caught by bottom trawl operated in the southeastern Arabian Sea. Morphometric measurements and indices were recorded and age and growth rate were estimated based on statolith microstructure analysis. This study is important, because no recent sighting record is available from the Arabian Sea and from the Indian Ocean in general and no information is known on its growth rate.

Material and methods

A single specimen of *L. reinhardti* was collected from the cephalopod catch landed by a commercial bottom trawler in Cochin Fisheries Harbour (CFH), Kerala, India on 7th October 2016. The specimen was caught from southeastern Arabian Sea (off Kollam : 8º 47' N; 76º 08' E) by using a bottom trawl net with codend mesh size of 20 mm, from 80 m depth.

The specimen was identified as per the key of Voss (1980). The morphometric measurements such as dorsal mantle length (DML), mantle width (MW), head length (HL), head width (HW), arm length (AL1, AL2, AL3, and AL4), fin length (FL) and fin width (FW) of specimens were measured to the nearest mm as given by Roper and Voss (1983) and sexual maturity was assessed using Lipinski's scale (Lipinski, 1979). Indices of length were expressed as percentage of dorsal mantle length. The specimen was deposited at the Designated National Repository (DNR), CMFRI, India with accession number (DL.1.2.1.2).

Statoliths were extracted and processed for age estimation according to Arkhipkin and Shcherbich (2012). The total statolith length (TSL) was measured using a Nikon microscope (Model: *Eclipse 80i*) and the statoliths were mounted on a microscopic slide, keeping the anterior portion on top. Statolith was carefully ground with fine sandpaper (1000 grit). Growth increments were examined under the same microscope at magnification of 60×10 x and observed rings were counted by averaging three counts of the increments

The statolith growth index was calculated as,

$$\text{Statolith growth index} = \frac{TSL}{DML} \times 100$$

Increments were counted from the first check (hatching ring) to the edge of the lateral dome, where increments were most clearly visible (Villanueva,1992; Dawe,1985). Current research and past research support the one increment per day hypothesis (Jackson, 2004). The hatching date was back-calculated from the count of increments and the date of capture. The daily growth rate (DGR) was calculated using the equation:

$$DGR = (W2-W1)/T$$

Where, W2 and W1 were dorsal mantle length (DML) at the beginning and end (individual size), and T is total age in days.

Photographic images of specimen were taken with a Nikon Coolpix camera.

Results

A single immature female specimen of *L. reinhardti* (Steenstrup, 1856) with DML of 118 mm (Fig. 1; Table. 1) were collected along with *Uroteuthis (Photololigo) duvaucelii* and other mesopelagic squid *Abralia trigonura*.

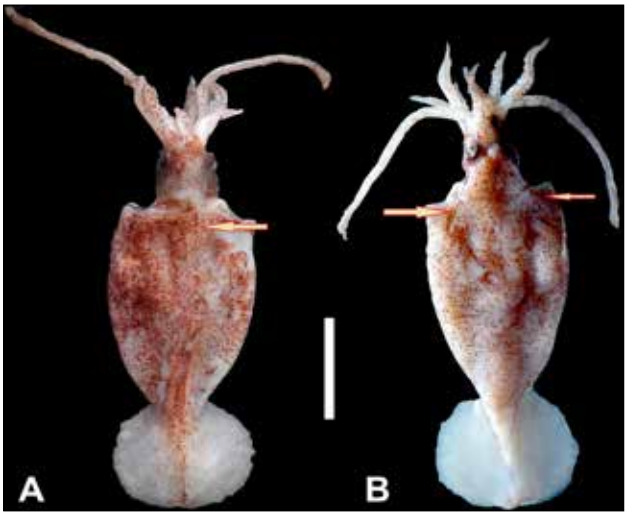

Fig. 1. *Liocranchia reinhardti* collected from Southeastern Arabian Sea (118 mm DML, Immature female). A) Dorsal side and B) Ventral side (Scale = 5 cm)

Table 1. Morphometric measurement and indices in relation to mantle length of *L. reinhardtii* from southeastern Arabian Sea

Measurements	Length (mm)	Morphometric Indices (%)
Total length	223	189.0
Dorsal mantle length	118	100.0
Mantle width	45	38.1
Fin length	40	33.9
Fin width	48	40.7
Arm I length	16	13.6
Arm II length	22	18.6
Arm III length	38	32.2
Arm IV length	29	24.6
Tentacle length	77	65.3
Tentacular club length	16	13.6
Total weight (g)	23.2	

Description of specimens

The members of the sub family Cranchiinae have cartilaginous tubercles on the mantle and several small photophores on the bulb of the eye (Voss, 1980). The mantle is elongate and spindle shaped (Fig.1).The genus *Liocranchia* is characterised by paddle shaped fins; fuse dorsally with growth, cartilaginous strips in inverted V-shaped pattern (2 numbers) with tubercles which extends from each funnel-mantle fusion.

Based on the presence of cartilaginous tubercles on ventral cartilaginous strips of mantle; tubercles on the dorsal median line of the mantle; short arms with no stalk and large protruding round eyes with fourteen oval photophores, the specimen was identified as *L. reinhardti.* The specimen had a DML of 118 mm and weight of 23.2 g. Detailed morphometric measurements and indices are given in Table 1. Compared to DML, highest morphometric index was observed in tentacular length (65.3%) while the lowest index was for arm I (13.6%).

Age and growth

The statolith of *L. reinhardti* had two foramen, situated near the wing. They had a well-developed lateral dome and a short, curved rostrum (Fig.2). Statoliths were of translucent nature and lacked coloured growth zones. They were fragile and relatively small. During grinding both statoliths were broken off. The total length of the statolith were 797 μm (0.79 mm). The relative size of the statolith were 0.67 % of DML. The statolith had 71 increments which revealed the age as 71 days with growth rate of 1.66 mm DML/day and 0.32 g body weight/day. The hatch date back calculated from the date of capture was 29 July 2016.

Discussion

The present record of the specimen from southeastern Arabian

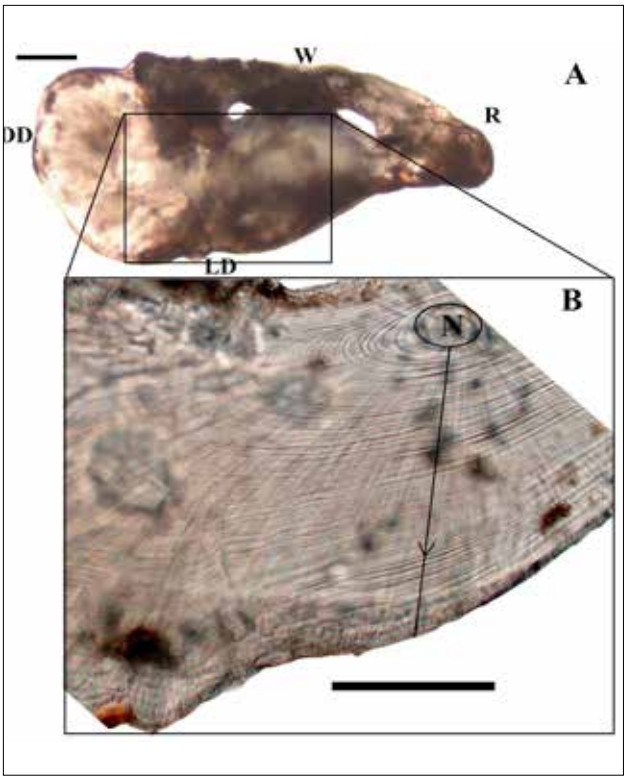

Fig. 2. Light micrograph of statolith of immature female (118 mm DML) *Liocranchia reinhardti* from Arabian Sea. A. General view of statolith (R: Rostrum; LD: lateral dome; DD: Dorsal dome. B. growth increments in the statolith (Scale=100μm). Arrow indicates the plane in which increment counts were made.

Sea at 80 m depth confirms the presence of *L. reinhardti* in the area subsequent to the reports of its oceanic in mesopelagic waters of Arabian Sea by Paitkowski and Welsch (1991). Studies from Hawaiian waters also reported this species from near surface water in the upper 100 m depth (Young *et al.,* 1978).

The one day one increment has been validated in the mesopelagic squid *Abralia trigonura* from north Pacific (Bigelow, 1992) and *Chiroteuthis calyx* and *Octopoteuthis deletron* from off California (Hoving and Robison, 2017). The relative size of statolith (0.67%) in *L. reinhardti* were less than other cranchia squids such as *Cranchia scabra* (Arkhipkin, 1996). The maximum size of the statolith of giant squid *Architeuthis* sp. with mantle length 1680 mm was 2.6 mm with an index of 0.15% (O'Shea, 2013) and for a medium squid (423 mm DML) mature female *Ancistrocheirus lesueurii* statolith length was 2.9 mm (0.69% of DML) (Arkhipkin, 1997). Age and growth study of *L. reinhardti* using statolith from the central east Atlantic showed the growth rate ranged from 1.25 to 1.42 mm/day (Arkhipkin, 1996). In the present specimen, the growth rate was 1.66 mm/day which may be due to comparatively high temperature prevailing in the Arabian Sea. The average sea surface temperature in the Arabian Sea was ~28ºC (Jeswal *et al.,* 2012), whereas in central east Atlantic was ~25.3ºC (NOAA, 2017). Cephalopods has

temperature sensitive growth and rising water temperature accelerates growth rates (Forsythe, 2004).

In the paralarval to immature stage, this species has an epipelagic phase of life and they grow rapidly (170-200 mm ML) by age of 4-5 months, then they change their life style to deep water phase (Arkhipkin, 1996). As the age of present individual was estimated as 2 months old, this species might occur just above the epipelagic zones of Arabian Sea. No specific growth zone was observed in the statolith indicating that the specimen underwent ontogenetic shifts from shallow water to deep water habitats. The formation of growth zones in the statolith are related to ontogenetic shifts (Arkhipkin, 2005) and this species is reported to grow to 250 mm DML size (Jereb and Roper, 2010).

This information is preliminary, more study essential to understand the age, growth and distribution of *L. reinhardti* from Arabian Sea.

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