

# Growth and trophic position of larval pelagic goby, *Sufflogobius bibarbatu*s in the Northern Benguela upwelling system

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## Introduction

During the past 40 years the fish community structure in the Benguela current upwelling system has changed dramatically due to anthropogenic impacts such as overfishing and increasing climate changes (Boyer et al., 2001). After the collapse of the sardine and anchovy populations in the 1970s the pelagic goby (*Sufflogobius bibarbatu*s) has increased its population size and became an important prey for hakes, horse mackerels, sea birds and seals (Gibbons & Salvanes, 2004). The species is endemic to the region and reaches a maximum length of 17 cm (Bianchi et al, 1999). It shows a remarkable tolerance to hypoxic conditions, lives in the company of large jellyfish and even feeds on them (Utne-Palm et al., 2010). The physiological adaptations of the species and its antipredator and foraging behavior support the survival of the goby population even under increased predation pressure.

## Results

### Growth

Best reading results were obtained when otoliths were embedded in immersion oil (ZEISS)(Fig.2). Other media such as Canada Balsam, epoxy resin, Euparal or cedar oil were less successful.

Validation of daily increment reading was done by marginal increment method and proofed to be daily increment deposition.

The material comprised larvae and juveniles between 3.5 and 31.5 mm. The maximum age found in the larvae investigated was 187 d at a length of 31.5 mm. The Gompertz growth curve (Fig.3) was estimated as

$$L_t = 2.120 \times e^{2.749(1-e^{-0.0187 \times t})}$$

indicating a hatching length of 2.12 mm.

## Material

A total of 255 larvae and early juveniles of *S. bibarbatu*s were collected during two cruises with the South African FRS Africana in December 2009 and the German FS Maria S. Merian in February 2008 along the Namibian coast. Distribution of gobies was restricted to cooler waters <21°C, moving northward with cool Benguela waters in late summer 2008 (Fig.1).

For the determination of age and growth sagitta otoliths were removed, cleaned and mounted in immersion oil for at least one day. Digital images were taken and radius and increment width of the otoliths measured with a computer image-analysis software.

Daily rings were counted and the correlation between SL and age in days analysed by fitting a Gompertz model:

$$L_t = L_0 \times e^{k(1-e^{-G \times t})}$$

For diet analysis fish were dissected and the total gastro-intestinal contents removed. The stomach fullness was estimated under a dissecting microscope and classified into five different grades. Prey items were identified and sorted according to higher taxonomic groups.



*Sufflogobius bibarbatu* larva

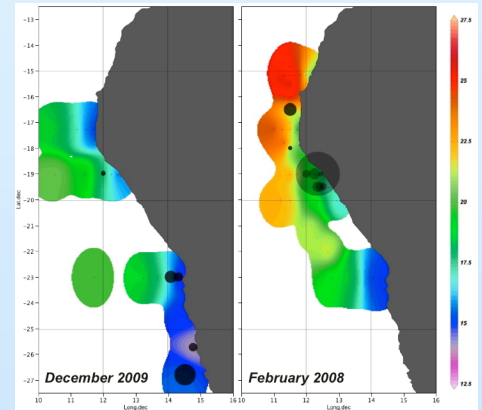


Fig. 1: Seasurface temperatures during Africana and Merian cruises

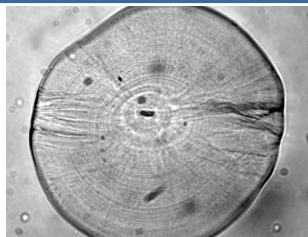


Fig. 2: Sagitta of a 11 mm goby.

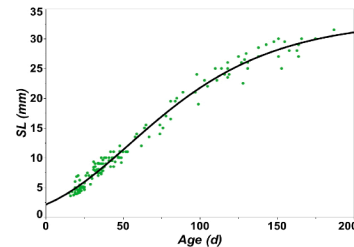


Fig. 3: Gompertz growth curve for larval gobies.

## Conclusion

Early life stages prefer temperatures <21°C. Growth model produced for early stages fits well literature data. Growth is slow with a daily average varying on a seasonal basis between 0.14 and 0.31 mm d<sup>-1</sup>. Larvae of pelagic gobies in the northern Benguela upwelling system seem to rely mainly on small pelagic copepods as food. Diatoms or detritus are not important.

## Food analysis

There was a clear difference in stomach fullness of larvae between day and night catches. At night, most larvae had empty (Fig.4) or <15% filled stomachs.

Calanoid and cycloid copepods are the main prey and contributed most to the stomach content in all size groups. A shift from cyclopid to calanoid species could be observed at about 15 mm SL. This shift can be related to the prey size, showing cyclopid copepods with an individual volume of <0.2 mm<sup>3</sup> while calanoid copepods normally showed volumes of 0.05 to 2.5 mm<sup>3</sup>.

Some euphausiids were taken up by larger larvae. Diatoms were taken up only occasionally.

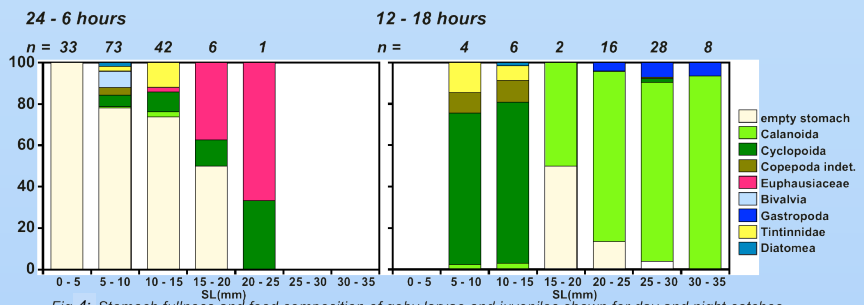


Fig. 4: Stomach fullness and food composition of goby larvae and juveniles shown for day and night catches.

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