Preliminary results on early growth of the black anglerfish, *Lophius budegassa,* in the Bay of Biscay using otolith microstructure

Hernández, C.*, Landa, J., Barrado, J., Antolínez, A.

Instituto Español de Oceanografía (IEO), Centro Oceanográfico de Santander, Promontorio de San Martín s/n, Apdo. 240, 39180 Santander, Spain.

* Email: carmen.hernandez@st.ieo.es

IMPORTANCE OF THE STUDY

The study of the daily growth increments in otoliths of young fish is a complex and time-consuming methodology, but is an useful tool for determining important **early life history** characteristics associated with age and growth of juvenile fish, such as hatch dates, annual growth pattern, reproductive and recruitment patterns, settlement and mortality rates (Campana and Jones, 1992).

Black anglerfish (*Lophius budegassa*) is an **important** species in European bottom **fisheries** (ICES, 2010), and the knowledge of the age and growth is necessary for the stock assessment using age-structured models.

There is one only study on daily growth of this species, performed in Mediterranean Sea (La Mesa *et al*., 2008). The relevance of this study lies in the fact that it is the **first** to be held in **Atlantic** waters. It is important to know the daily growth pattern in each area given the geographic variations in growth.

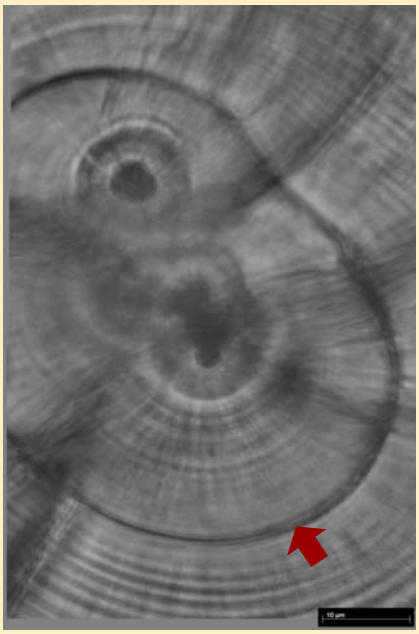


Fig. 2. Microstructure of *lapilli* otolith of *L. budegassa*.

OBJECTIVES

The main objective of this study is to investigate the early life history of *L. budegassa* by otolith (*lapilli*) daily increment analysis (**Fig. 1**). These studies allow us:

- To estimate the **ages** of juvenile specimens through daily microincrement counts.
- To calculate individual **growth rates**.
- Thus, to estimate the **birth date** distribution of juveniles.

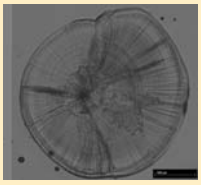


Fig.1. *Lapilli* otolith of *L. budegassa*

MATERIAL & METHODS

Samples of demersal juvenile *L. budegassa* specimens (n=17) were collected during the bottom trawl surveys carried by the RV "Cornide de Saavedra" in the Bay of Biscay during September-October 2010.

Otolith (*lapilli*) (**Fig. 1, Fig. 2**) microstructure analysis was conducted on specimens ranging from **60 to 152 mm TL**. Otolith were mounted on glass slides with a thermoplastic glue (Cristalbond). Thin sagittal sections were produced by grinding, using automated polishing wheels. After grinding, each sample was cleared in immersion oil and viewed at **400× magnification** (and 1000x for analyzing the primordium zone) by means of a light microscope equipped with a digital camera. The image was transmitted to a computer and examined by using an **image analyzer** (Visilog 6.4/ TNPC 4.2).

Fish were **aged** by growth increment counts on *lapilli* otoliths, presuming they were laid down with a daily periodicity. The widths of these supposed daily increments were examined along the longest radius and counted and measured starting at the hatch check (Campana and Jones, 1992).

The **hatch date** distribution was estimated by subtracting the number of otolith growth increments from the date of capture.

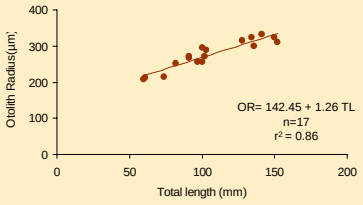
RESULTS & DISCUSSION

First early life history events

The primordium of *lapilli* otolith consisted of **multiple cores** and a very defined increment that could be most likely the "**hatching check**" (**Fig. 2**) as Hislop *et al.* (2001) reported on the other European congener, *L. piscatorius*. A second less evident check, the possible "**first feeding check**", was also observed.

The initial increment sequence observed between these two checks may reflect the period of **endogenous feeding**, providing an estimated of yolk sac duration of about **15 days** (ranged 11-23 d). This result is very **closed** to the 18 days estimated by La Mesa *et al.* (2008) for this species in the Mediterranean Sea.

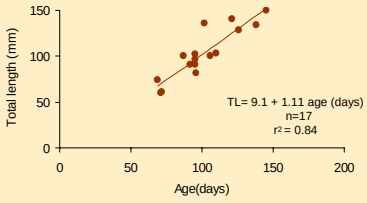
Otolith radius - fish length relationship



Otolith radius (OR) - fish length relationship is useful to determine the potencial use of otolith microstructure width in growth studies. When otolith size and fish size are highly correlated, and therefore, when this relationship is predictable, growth trajectories can be **back-calculated** based on otolith increment width (Campana and Neilson, 1985).

The results shows a **strong linear relationship** between otolith radius and fish length (r^2=0.86, p<0.001) which will allow us to **back-calculated** growth trajectories.

Age - fish length relationship



- Age estimated ranged from 71 to 145 days based on growth increment counts.

- The daily growth rate of juvenile *L. budegassa* was estimated by fitting a linear regression to the whole age length data. The growth rate calculated by pooling all aged fish was **1.11 mm/day** (size range 60-152 mm TL), **similar** to that estimated for Mediterranean waters: 0.8-1.02 mm/day (size range 54-196 mm TL) (La Mesa *et al*., 2008). Thus, juveniles **at least up to 152 mm** TL collected in October were born the same year and belong to **age class 0**. These results have implications for estimating a more accurate annual growth pattern and a new annual age estimation criterion, due to the criterion based on *illicia* (Duarte *et al*, 2002) that was used in the assessment of Atlantic stocks was being underestimated (Azevedo *et al*., 2008).

- The **hatch date** distribution was back-calculated from the date of capture. This would indicate an spawning season spread over a long period, from **May to August.** This result is **consistent** with the spawning period (mainly May to July) obtained in the histological study of Quincoces *et al*. (1998) in the Bay of Biscay.

CONCLUSION & FURTHER ANALYSIS

Otolith (*lapilli*) daily increment analysis gives us a better understanding of the **life cycle** of the species and it is fundamental for **validation of annual growth pattern in the early stages** of life. This will have implications for the stock assessment of *L. budegassa* when used age-structured models and for a more accurate estimation of the population demographic structure.

For further studies, a **larger sample** should be analyzed to enable us to consolidate these findings.

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REFERENCES

- Azevedo, M., Cardador, F., Costas, G., Duarte, R., Fariña, A.C., Landa, J., Sampedro, M.P. 2008. Final Report: Improving the quality of southern anglerfish stocks assessment (ABA). (UE DG FISH/2004/03-22).
- Campana, S.E., Jones, C.M. 1992. Analysis of otolith microstructure data. In: D.K. Stevenson and S.E. Campana (eds.). Otoliths microstructure examination and analysis. *Can. Spec. Publ. Fish. Aquat. Sci*., 73-100.
- Campana, S.E., Neilson, J.D. 1985. Microstructure of fish otoliths. *Can. J. Fish. Aquat. Sci.*42: 1014–1032.
- Duarte, R., Landa, J., Quincoces, I., Dupouy, H., Bilbao, E., Dimeet, J., Marçal, A., *et al*. 2002. Anglerfish Ageing Guide. In Report of the 4th International Ageing Workshop on European Anglerfish. 40 pp.
- Hislop, J.R., Gallego, A., Heath, M.R., Kennedy, F.M., Reeves, S.A.,Wright, P.J. 2001. A synthesis of the early life history of the anglerfish, *Lophius piscatorius* (Linnaeus,1758) in northern British waters. ICES *J. Mar. Sci.* 58, 70–86.
- ICES. 2010. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 5 - 11 May 2010, Bilbao, Spain. *ICES CM* 2010/ACOM:11, 871 pp.
- La Mesa, M., De Rossi, F. 2008. Early life history of the black anglerfish Lophius budegassa Spinola, 1807 in the Mediterranean Sea using otolith microstructure. *Fisheries Research* 93, 234–239.
- Quincoces, I., Santurtún, M., Lucio, P. 1998. Biological aspects of black anglerfish (*Lophius budegassa*) in the Bay of Biscay waters during 1996–1997. ICES, CM 1998/O:47, pp. 1–28.