BIOLOGY OF SQUID (*Loligo vulgaris*) EXPLOITED BY RECREATIONAL AND COMMERCIAL FISHERIES

Supervisors: Beatriz Morales-Nin & Audrey Geffen

Working location: IMEDEA (CSIC/UIB), Mallorca, Spain (http://www.imedea.uib.es) and Biology Department Bergen University

Study area: Mallorca Island (W Mediterranean, Spain)

Background

The European squid, *Loligo vulgaris* Lamarck (1798), is one of the most exploited cephalopods in European waters (Pierce et al., 2010). In the Mediterranean Sea, this neritic squid is targeted by the trawl fishery (González and Sánchez, 2002), the artisanal fishery (hand-line-jigging with attraction lights and seine fishing; Guerra et al., 1994; Lefkadltou et al., 1998; Cabanellas-Reboredo et al., 2011; Ulaş and Aydin, 2011) and the recreational fishery (Cabanellas-Reboredo et al., 2014). A large recreational jigging effort is concentrated at specific grounds (inshore waters at 20-35 m depth) during the reproductive season of this species (winter-spring; Šifner and Vrgoč, 2004).

Recreational fishermen: two for one!

Objectives:

1) To describe the population size structure, age, growth, reproduction and longevity of the squid, *Loligo vulgaris.*
2) To validate the daily periodicity of the growth increments in *L. vulgaris* statoliths.
3) To establish the characteristics of the population exploited by the recreational and commercial fisheries.

Material and methods

Experimental work (objective 2)

A minimum of 30 squids will be collected alive by experimental fishing and keep at the LIMIA aquaculture facilities. Once the squids are acclimated they will be marked by a mantle injection of Sr.

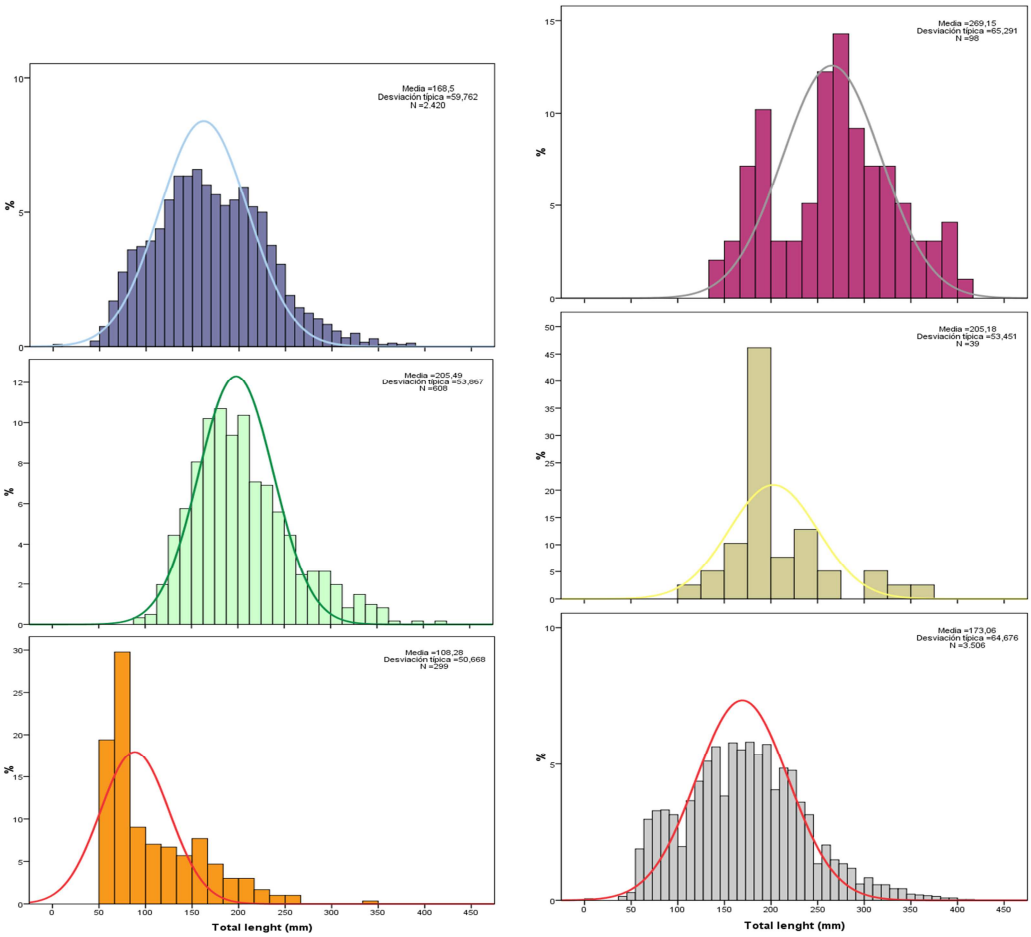
After 50 days the squids will be sacrificed, the statoliths collected and they will be polished and prepared for scanning electron microscopy (SEM) observation and Sr detection with X-ray methods. The number of growth increments laid down after the Sr mark will be compared to the rearing period to validate their daily periodicity.

A squid kept in captivity feeding.

Biological information (objective 1)

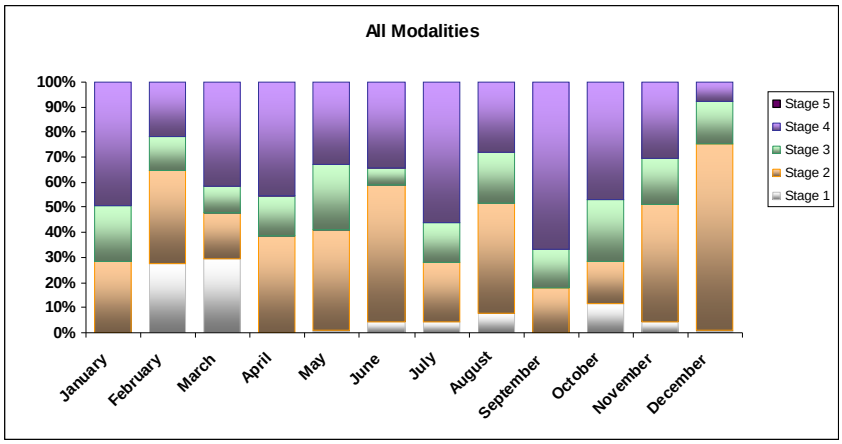
The sampling was carried out monthly on the Fish Warf and by experimental fishing during 2009. Length frequencies were obtained for commercial captures. The biological sampling includes records of size (dorsal mantle length), weigh, sex and sexual

maturity of 1400 squid. The statoliths were collected and stored at IMEDEA.



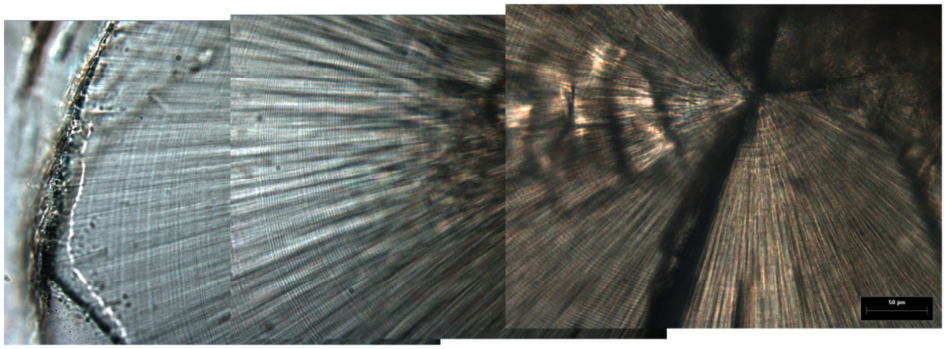
Preliminary length frequencies obtained from commercial and recreational fishing, respectively.

Length-weigh, maturity and growth will be determined for sexes and for capture method. Size classes will be identified and weighted through the use of size frequency analysis and arrayed to provide an empirical growth model for females and males, respectively.



Maturity evolution along the year.

Age will be determined from the growth increments in the statoliths to establish growth models, maximum ages, hatchdate and mortality.



Statolith extraction and microstructure

Exploited population (objective 3)

The data obtained in objective 1 will be used to analyze the population fraction exploited by the recreational fishery and by the commercial fleet. Management recommendation's would be developed in collaboration with the Balearic Islands Fisheries Directorate.

Expected results

1-Skills obtained

Field work: experimental fishing, management of life animals in an aquaculture facility.

Laboratory work: practice in schelorocronology, statolith preparation and interpretation, microscopy, image analysis systems, SEM EDAX use. Data analysis, modelling.

2-Publication:at least one SCI manuscript will be submitted at the end of the Master.

3-Experience gained: working in an international quality team, contact with managers.

Workplan

Month 01-03: The student will be at IMEDEA at least during 3 months to carry the experimental work and to learn the basics of statolith preparation and to gain knowledge on the species.

A short visit to Barcelona (Institut of Marine Ciencies) could be arranged to do the Sr detection and increment validation using SEM-Edax.

Month 4-8. The statolith preparation and interpretation will be completed at Bergen University.

Month 9-12. The final work will be carried out at IMEDEA.

Additional information

IMEDEA is situated in Esporles at 11 km from Palma, the main Island city. Housing could be arranged either in the town or in Palma, a bus services Esporles-Palma conexions.

IMEDEA will not charge fees and will supply lab material. Mallorca offers a wide range of possibilities and a mean life cost for a student could be 500 €.