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Unraveling the life cycle of two small gobies: age validation and determination

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Objectives

Aphia minuta and ***Crystallogobius linearis*** are small-sized neotenic and progenetic species, short lived (<1 year) and are target of a small-scale fishery on the W and central Mediterranean.

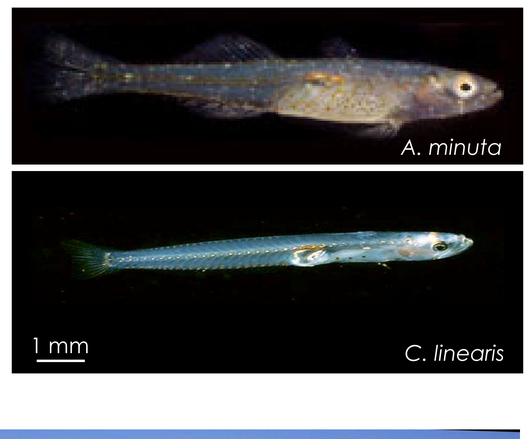
The fishery operates from December to March in concomitance with their coastal migration and shoaling in winter.

The biology of *A. minuta* was studied on the 90's[1] whilst nothing is known for *C. linearis*. Depending of the year the relative abundance of both species in the catches may differ notably with a clear repercussion on the price because *C. linearis* is less appreciated than *A. minuta*. The causes of such fluctuations are unknown.

The **objectives** of the present study were:

1-Establish the age and growth of both species as a first step to unravel their population characteristics.

2-Backcalculate their birthdates to support the hypothesis of two annual cohorts.



Results

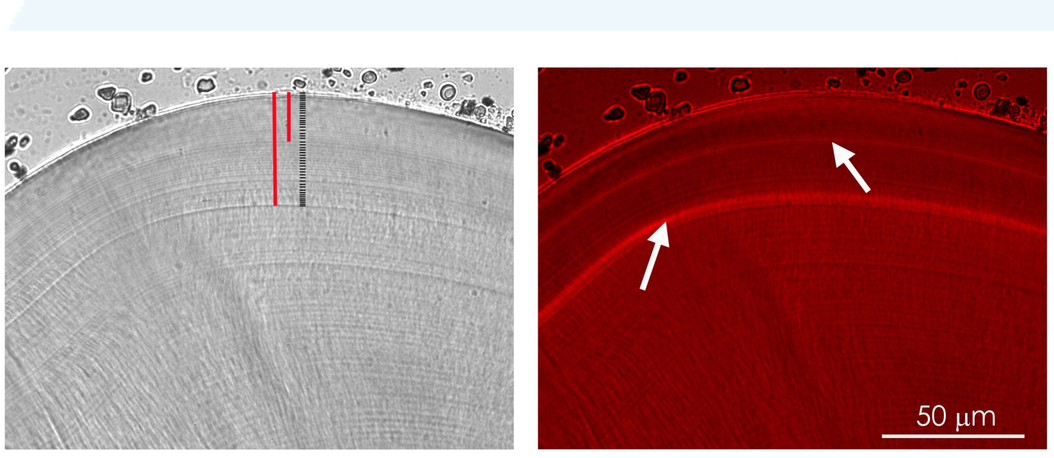
Direct increment periodicity validation

Wild specimens were captured and transported to the LIMIA facilities where after a week of acclimatization were marked with an Alizarine immersion bath (65 mg/L) for 23 h. Marking of *A. minuta* was repeated after 20 days. Fish were sacrificed at 10 days intervals and the experiment had a duration of 71 days.

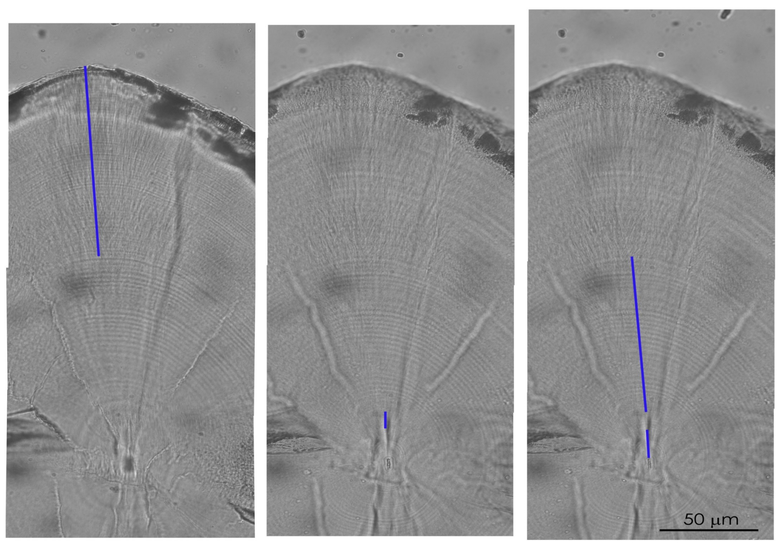
The relationship between the number of increments after the mark (DGI) and the experimental period (DE) were:

- ***A. minuta*** DGI = 1.1432DE - 8.3218; R^2 = 0.5757
- ***C. linearis*** DGI = 0.6667DE + 2.6667; R^2 = 0.5845

Low correlation may be due to poor growth and thin DGI under the detection limit of the microscope (0.45 µm at X400).



Aphia minuta otolith marked with Alizarine shown on brightfield mode (left) and under UV light (right). Note both Alizarine marks (arrows) and increment counts (black & red lines)



A. minuta otolith at three focal planes, showing the segments used for increment identification and count (blue lines) read at X40 and using the ObjectJ plugin of ImageJ free software

The fishery

A. minuta fishery in Mallorca (W Mediterranean) represented the 4.5% annual total effort, 3.8% total annual landings, and 7.1% of annual profits at first sale on 2017.

The transparent goby fishery is considered by the Commission of the European Communities (EU) as a 'special fishery' with a special management plan in place since 2006 (CE1967/2006) in which the fishery stakeholders participate[2].

Age and growth

Wild fish were captured during December 2015-April 2016 fishing season

- ***A. minuta***

Otolith nucleus elongated with a radius of 4.92 µm (0.63 SD)

Mean ICD width: 1.24 µm(0.45 SD)

Fish size: 24.2 to 40.69 mm TL

90 to 229 days of age. No correction made for hatch date-first increment formation.

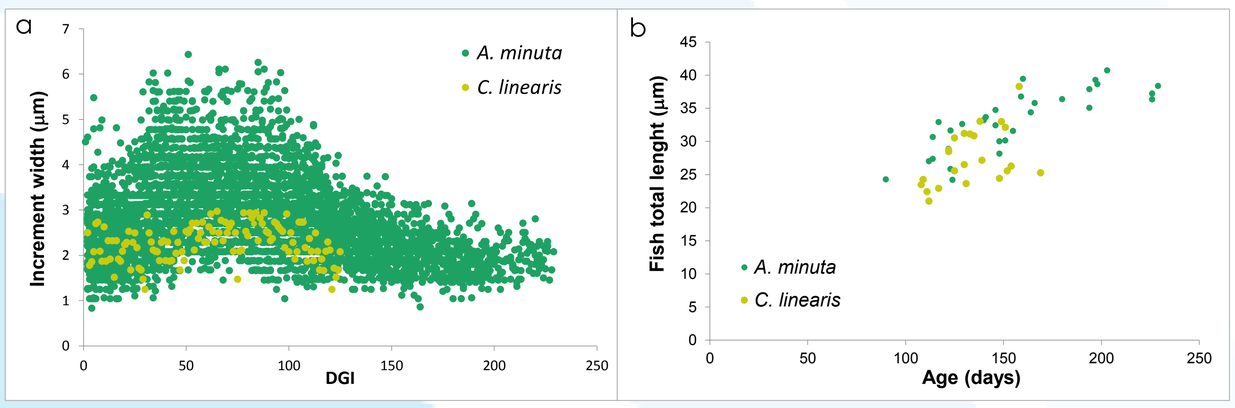
- ***C. linearis***

Otolith nucleus elongated with a radius of 3.77 µm (0.68 SD)

Mean ICD width: 1.13 µm (0.66 SD)

Fish size: 20.98 to 38.28 mm TL

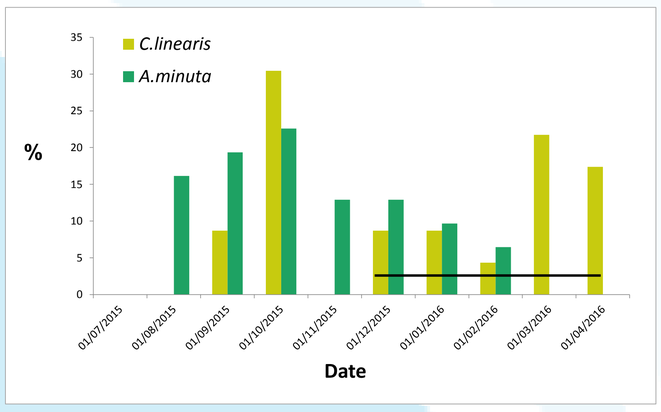
108 to 169 days of age. No correction made for hatch date-first increment formation.



A. minuta and *C. linaris* increment width (a) and age-TL relationship (b)

Conclusions

- ✓ The size and age range of *A. minuta* on the 2015-2016 catches was more restricted than the reported for the catches from 20 years ago (14-44 mm, 63 to 250 days of age)[3].
- ✓ The validation for the first time of the periodicity of *C. linearis* DGI opens a new field of work. However, in both species the rearing conditions seemed not to be optimal resulting probably in some unclear or undetectable DGI.
- ✓ Both species seem to have an end of summer to early winter birthdate, albeit *C. linearis* had a secondary peak in spring.
- ✓ The results supported the two spawning peaks for *A. minuta* and probably for *C. linearis* and that the fishery operates on the results of the previous spawning.
- ✓ This has to be considered for the management of this valuable resource.



Backcalculated hatch-date distribution
Black line: seasonal fishing period (December-April)

References: [1] Iglesias, M.; Morales-Nin, B. (2001). *Scientia Marina*, 65(3):183-192
[2] Morales-Nin, B.; Grau, A.M.; Aguilar, J.S.; Gil, M.M.; Pastor, E. (2017). *ICES Journal of Marine Science*, 74: 2053–2058
[3] Iglesias, M.; Brothers, E.; Morales-Nin, B. (1997). *Marine Biology* 129: 279-287