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Marking *Octopus vulgaris* beaks: age validation and life-event recording



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BACKGROUND and MAIN RESULTS



- Age and growth important for understanding the life history and for the assessment and sustainable management of their wild populations
- Octopuses lack hard structures for ageing, only stylets and beaks has been explored

- Daily deposition in beaks of *Octopus vulgaris*: only validated for a incomplete size range, and for known-age individuals younger than 1 month



- We validated daily deposition in the exploited size range by chemical and environmental marking of beaks

- We confirmed absolute ages in beaks of known-age octopuses for both, the whole pelagic and benthic stages

- Stress of the environmental markings was recorded in the beaks



Marking adults in captivity

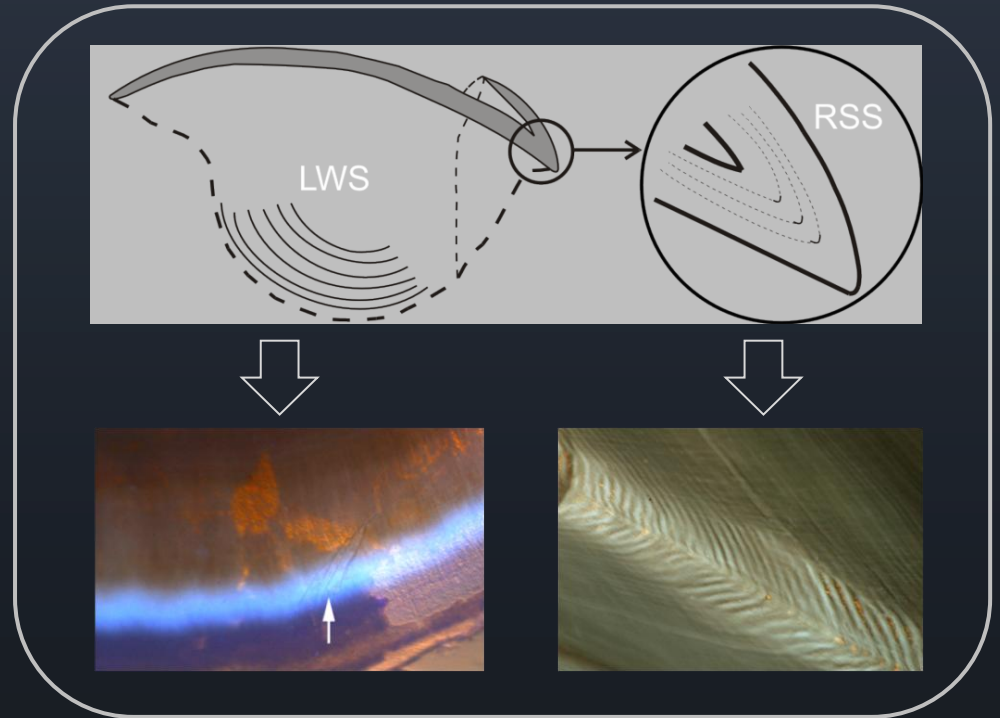


49 octopuses from Central East Atlantic (158-6000g) were marked in captivity

Chemical marking: injection of CALCOFLUOR



Environmental stress marking: THERMIC, CONFINEMENT, etc.



Preparation of Lateral Wall Surfaces

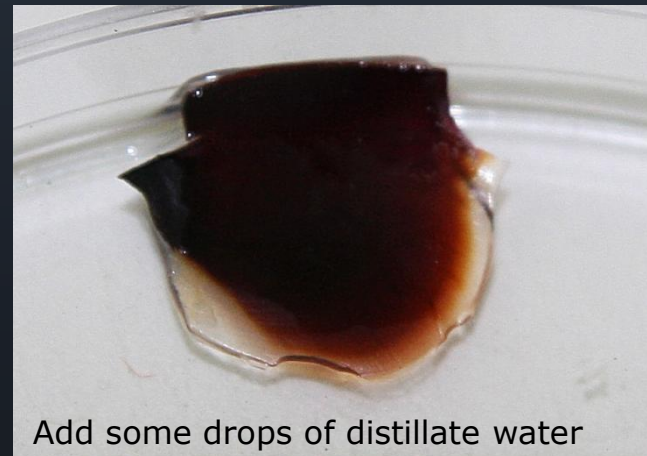
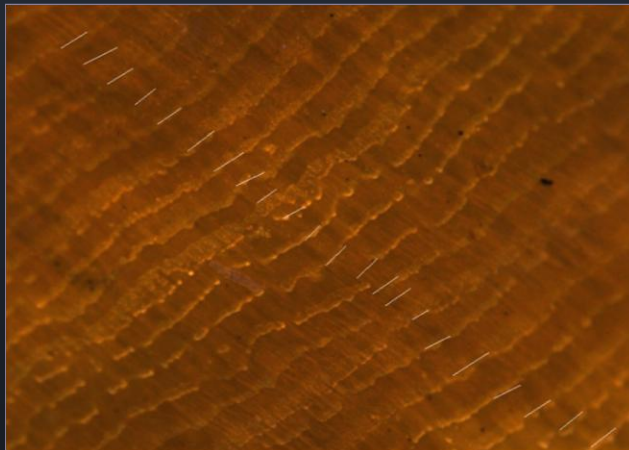
Inner surface of lateral wall in the upper jaw was prepared for each animal:

Lateral Wall Surfaces (LWS)

Hernández et al. (2001); Perales-Raya et al. (2010)



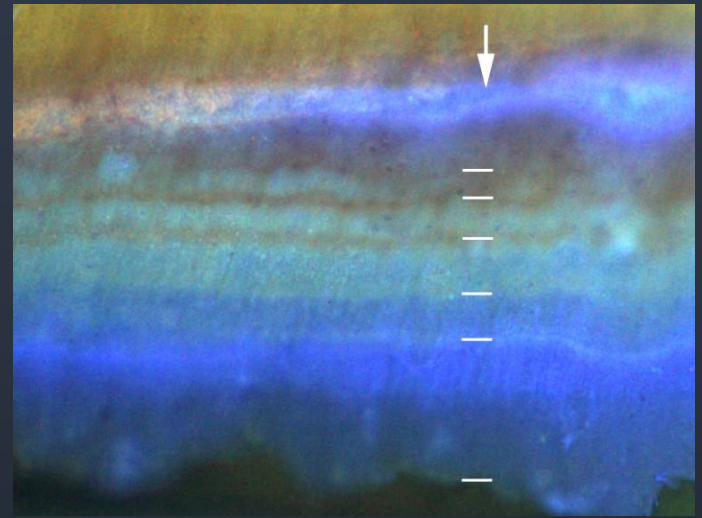
Epi-ilumination / 50-150X



Daily deposition in Lateral Wall Surfaces

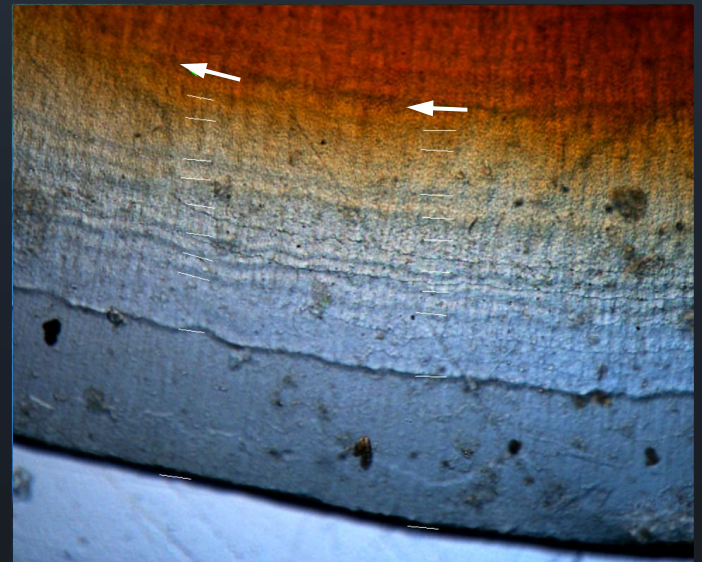
Chemical marking: CALCOFLUOR

14 positive marks in 12 individuals of 212-2450g BW) with a mean validated period of 14 days



CONFINEMENT marking

7 positive marks in 6 individuals of 158-3521g BW) with a mean validated period of 15 days

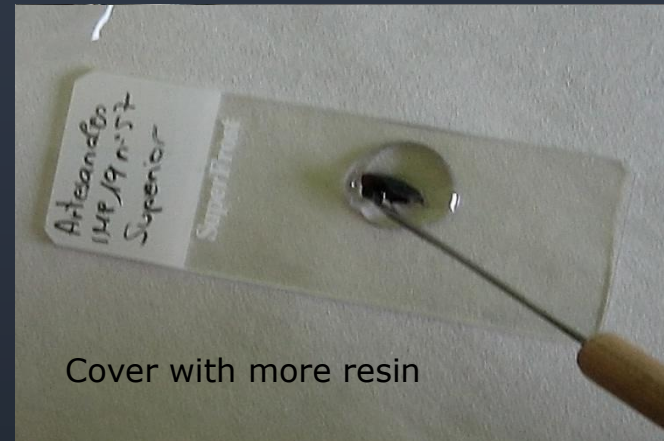


Preparation of beak sections

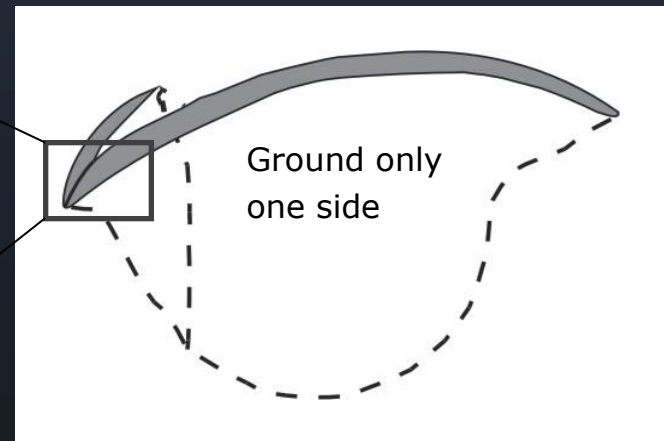
For each animal, Sagittal Sections of upper / lower jaws were prepared:

Rostrum Sagittal Sections (RSS)

Hernández-López et al., 2001; Perales-Raya et al., 2010



Epi-illumination / 200-300X



Daily deposition in beak sections

Mark of CAPTURE

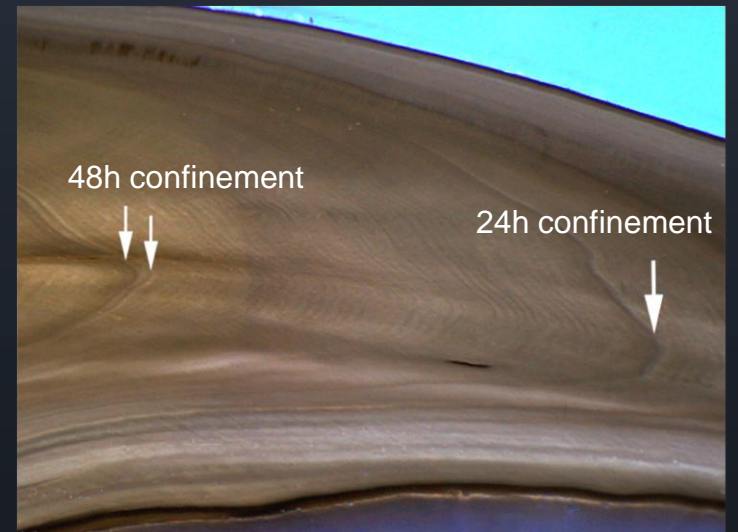
27 individuals registered the day of capture in the RSS (273-2450g BW) with a mean validated period of 32 days

Comparison of growth rates after treatments suggests that capture is the most stressful event



CONFINEMENT marking

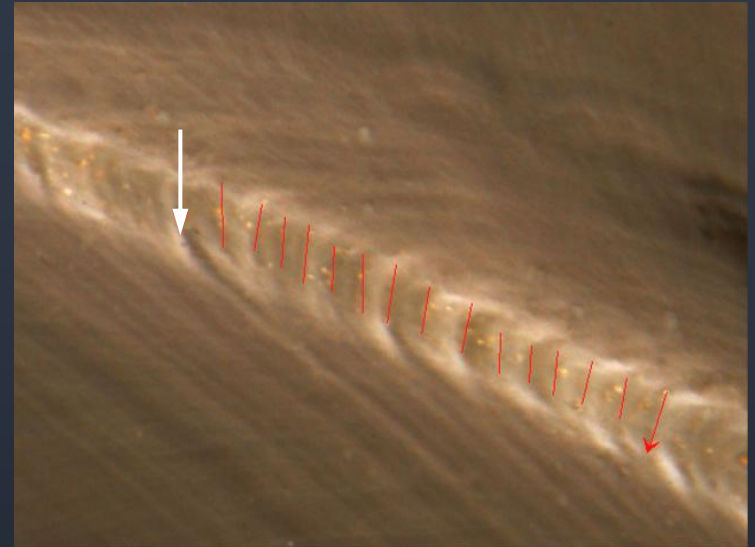
17 positive marks in 9 individuals (158-3521g BW) with a mean validated period of 17 days



Daily deposition in beak sections

THERMAL marking

11 positive marks in 9 individuals (400-2000g BW) with a mean validated period of 17 days



Mark of the MARKING PROCESS

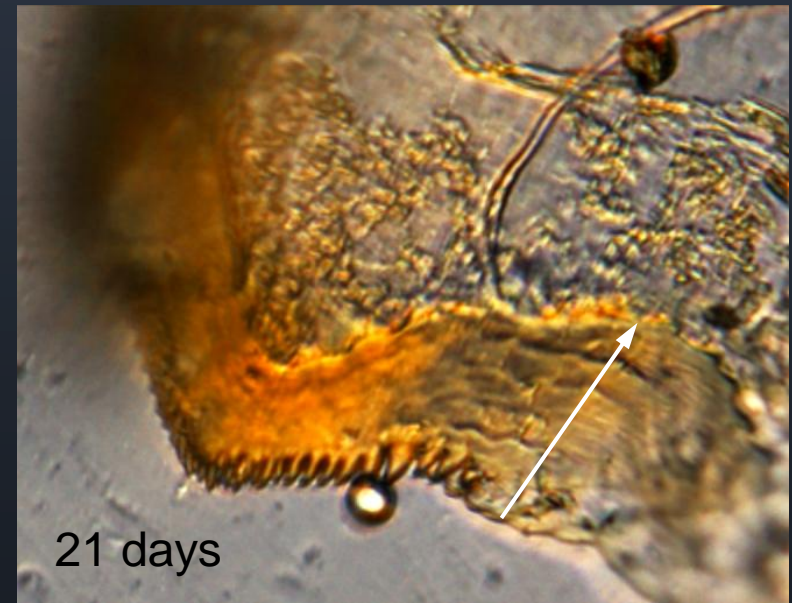
29 positive marks in 19 individuals of 273-2920g BW) with a mean validated period of 16 days



Known-age individuals



- 24 known-age individuals: pelagic stage up to 98 days old and juvenile-adult stage
- **PELAGIC PARALARVAE:** Increments in upper jaws the coloured region of lateral hood surface (LHS)

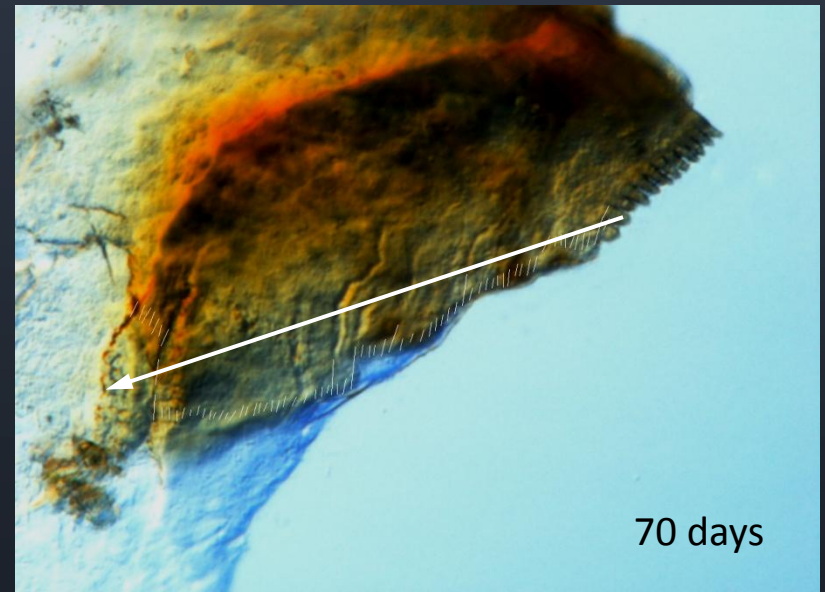
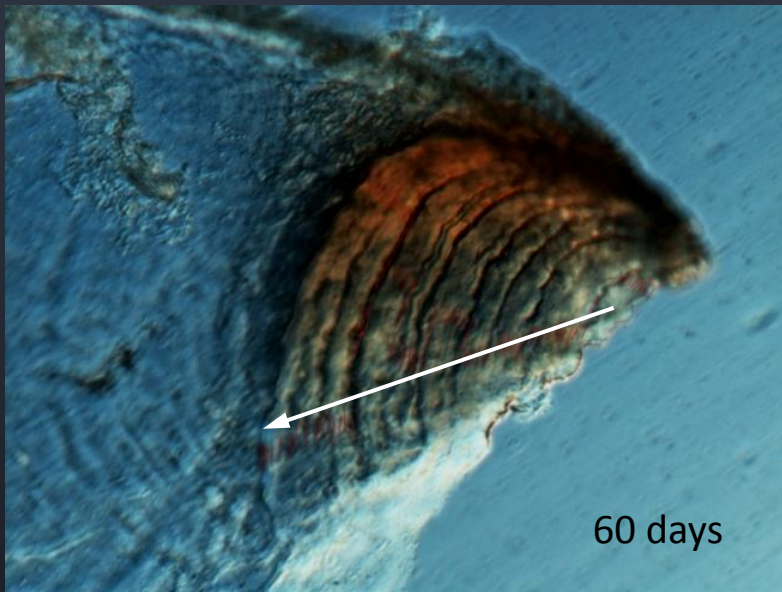


Differential Interference Contrast (DIC-Nomarski) to observe a 3D effect of the micro-increments. 400X

Known-age: pelagic paralarvae



PELAGIC PARALARVAE oldest than 1 month: Increments in the coloured region of lateral hood surface

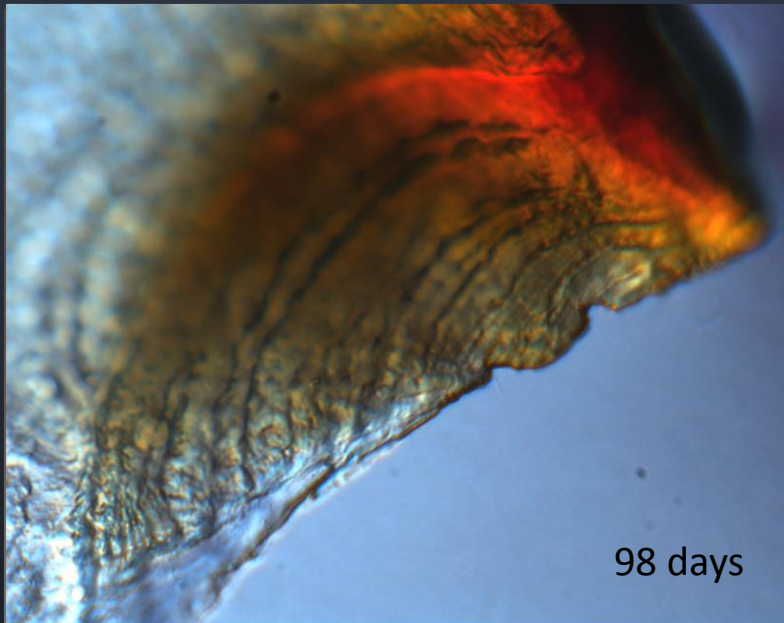


Differential Interference Contrast (DIC-Nomarski) to observe a 3D effect of the micro-increments. 400X

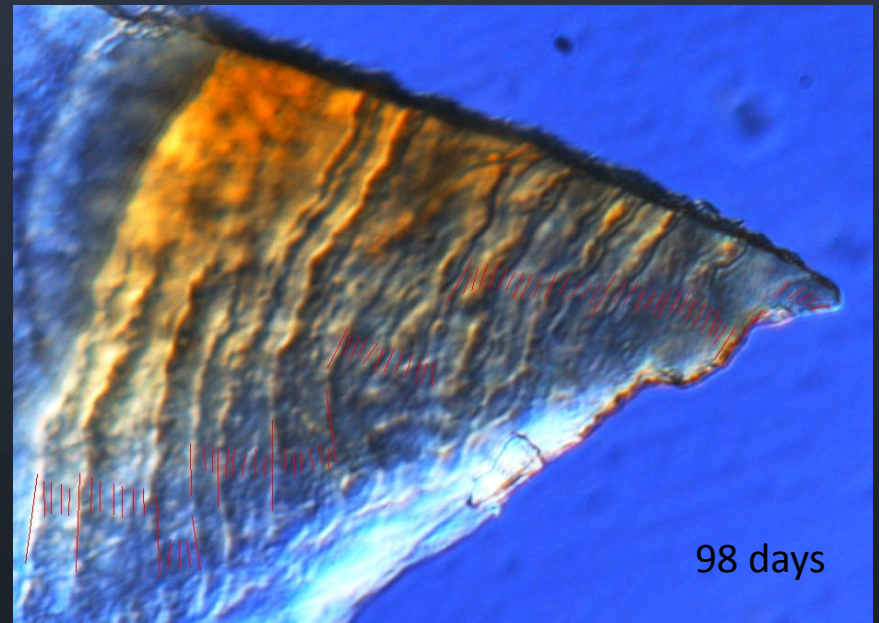
Known-age: transition to settlement



TRANSITION TO SETTLEMENT STAGE (98 days old): Increments in the coloured region of lateral hood surface



98 days



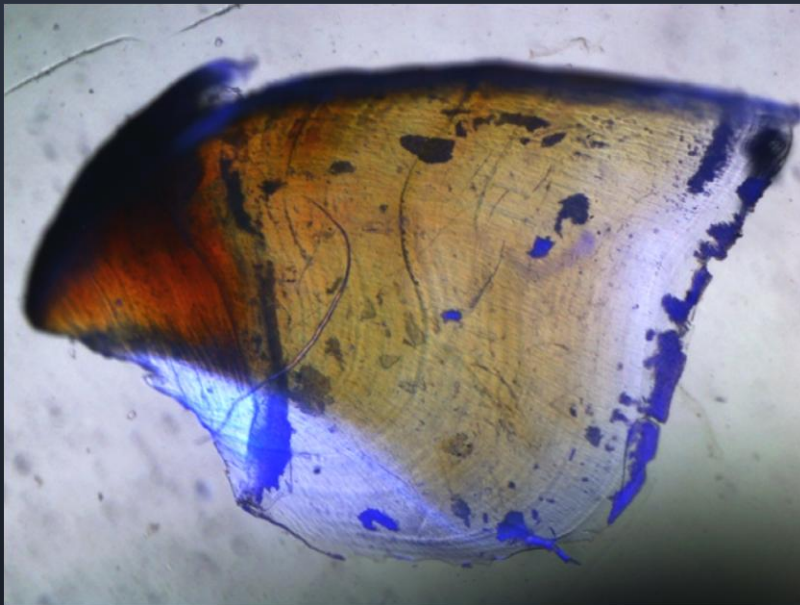
98 days

Differential Interference Contrast (DIC-Nomarski) to observe a 3D effect of the micro-increments. 400X

Known-age: benthic stage

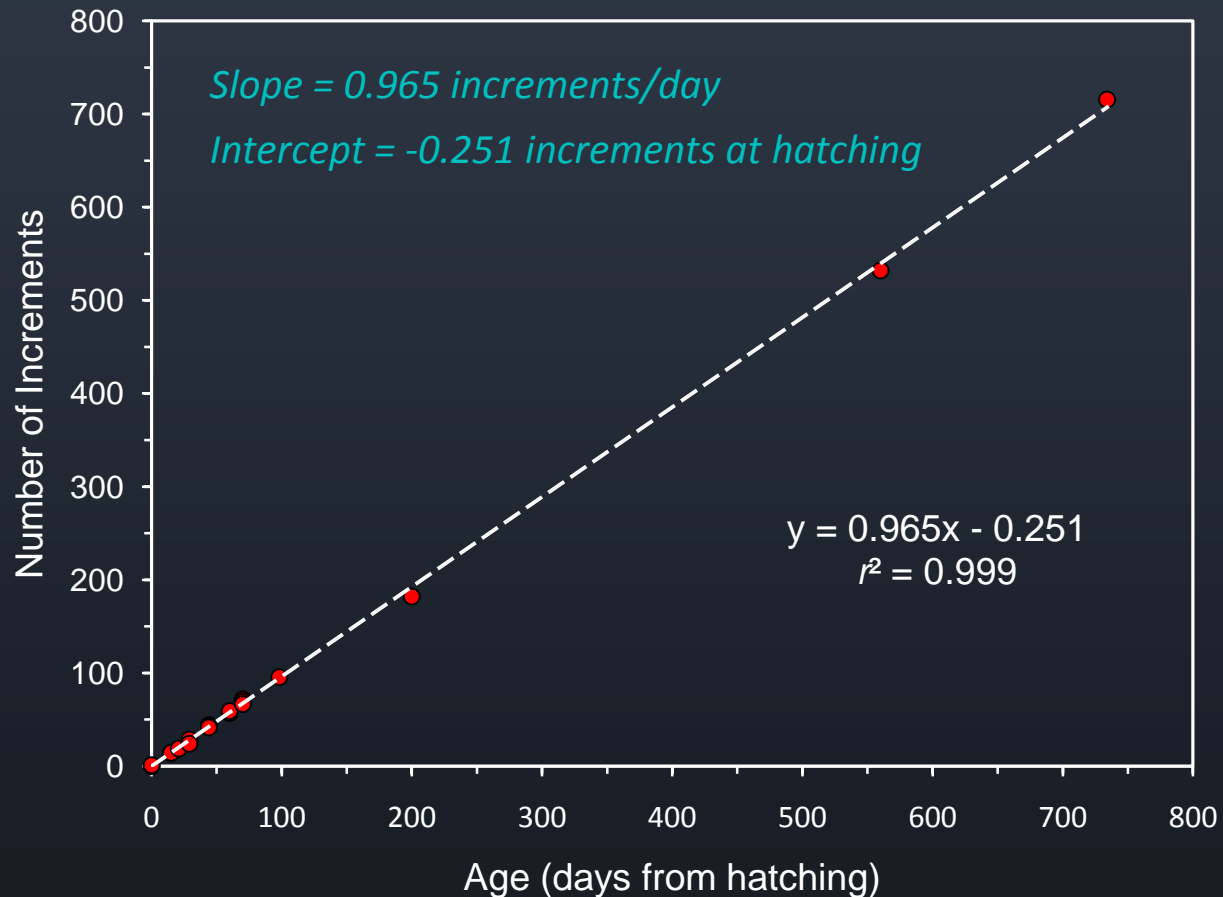


Increments in lateral wall surface and beak sections in one juvenile (200 days), one male (724 days) and one female (560 days)



Confirmation of absolute ages

Positive linear relationship age-increments for the 24 known age octopuses born in captivity (from hatchling to 726 days old)



CONCLUSIONS



Lateral Wall Surfaces →



- Validated daily periodicity
- Number of increments aligned with true ages in adults
- *First and last increments are usually difficult to count*

Rostrum Sagittal Sections →



- Validated daily periodicity
- Quality stress marks, life-event recorders
- *Some underestimation of absolute age in adults (beak erosion-feeding)*

Lateral Hood Surfaces (pelagic stage) →



- Validated daily periodicity
- Number of increments aligned with true age from hatchling to 98 days old
- Potential recording of stress in paralarvae

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¡Muchas gracias!

Thank you!



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