

WKARA2 [Workshop on Age reading of European anchovy (*Engraulis encrasicolus*)]  
28 November -2 December 2016  
Pasaia (Guipuzcoa, Spain)

# Problems identification in ageing of otoliths of Anchovy (*Engraulis encrasicolus*) from Divisions VIIIcb and IXa North.

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INSTITUTO ESPAÑOL  
DE OCEANOGRAFÍA

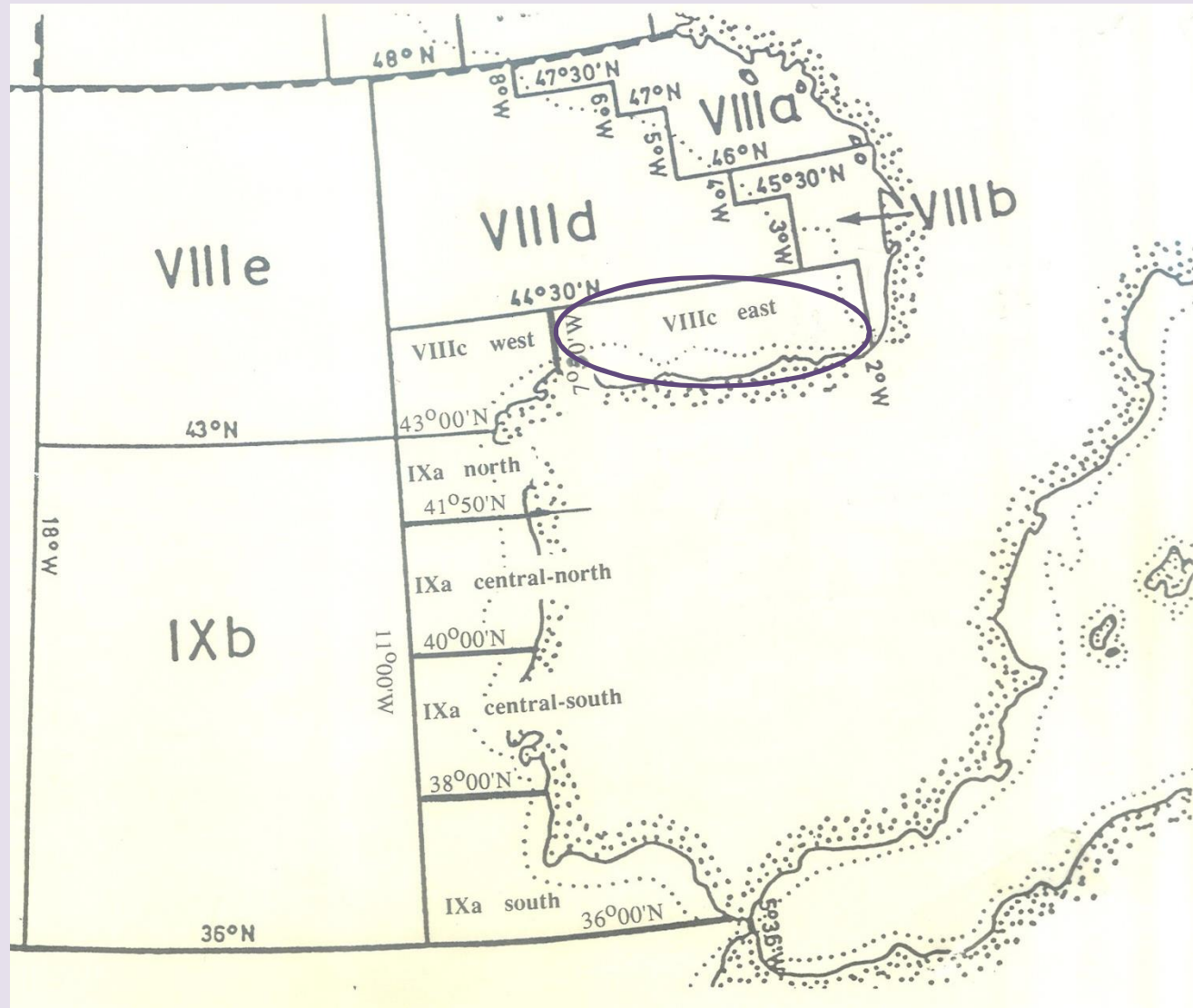
# Age interpretation criteria

followed by Uriarte et al., (2002 and 2016) and ICES WKARA 2009

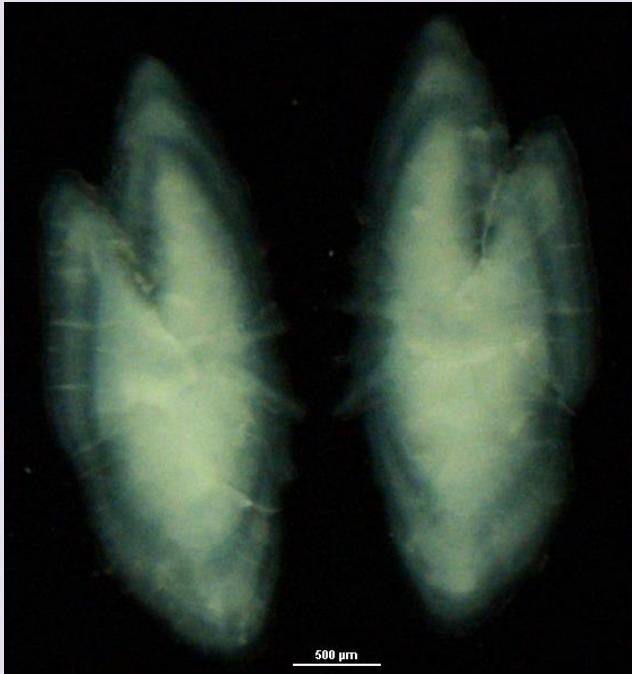
The method is based on the knowledge of the annual growth pattern of the anchovy otoliths, of the seasonal growth of otolith edge by ages and of the most typical checks.

- “ A set of an opaque and hyaline zone corresponds to an annual growth zone (annulus).
- “ The date of birth is conventionally assumed to be the 1st of January and the fish is assigned to a year class on this basis (if an otolith is collected during the first semester the age group correspond to the number of hyaline zones, if the otolith is collected from a fish caught during the second semester, the hyaline edge will not be considered)
- “ Maximum otolith growth (opaque ring formation) takes place in summer months, and it decreases in winter time (hyaline ring formation). However, in some areas, the starting of the opaque edge during spring time changes with ages, being remarkably sooner at age 1 than at older ages.
- “ Typical annual growth of the otoliths is established, by which annulus width during the first, second and third years of life (corresponding to 0, 1 and 2 years old groups) decreases progressively. Older ages present a rather similar width to the one experienced at previous ages.
- “ Typical checks occur before and after the first winter ring is formed, during age 0 and age 1 of anchovy. The checks before the true hyaline winter ring are generally present around the nucleus, these checks are named C05 and C08. The most typical ring formed after the first true hyaline ring is formed during June/July in many of the 1 years old anchovy at the peak of their first spawning period, which is considered to be a spawning check. According to its position in relation to the total expected annual growth these checks are named C 12, C15 or C18 if laid down around 50% or 80% of expected annual growth.

# ICES Sub-division VIIIc East



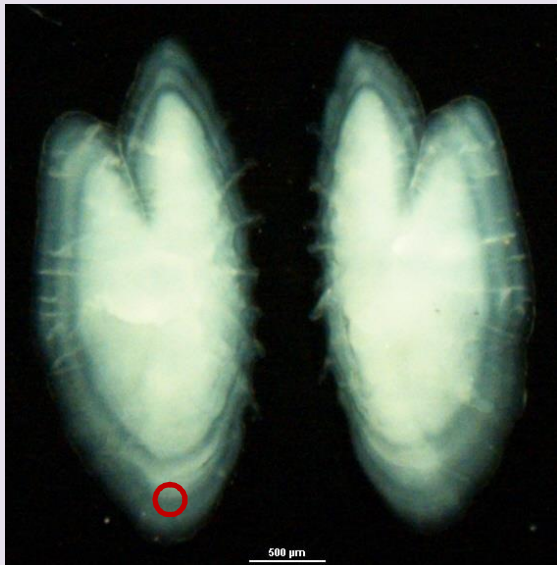
*VIIIc East*  
*2 or 3 years old?*



March 16, 2016. n° 11, **155 mm**. 2 years old?. Hyaline edge  
Rings marked on the rostrum and anti-rostrum.  
Are there annual rings or maybe spawning ring C 15?



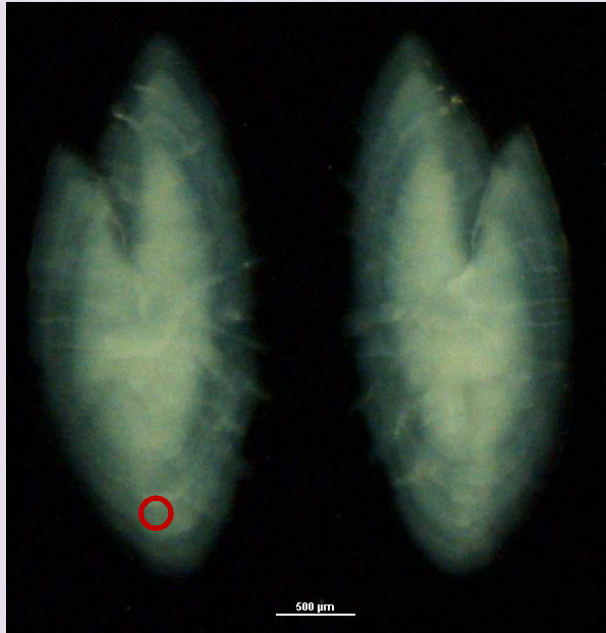
March 16, 2016. n° 23, **165 mm**. 2 years old?.  
Hyaline edge.  
Rings marked on the rostrum and anti-rostrum.  
Of the 1st ring to the base, there is one equidistant.  
Is it a spawning ring C 15 or other annual ring?  
and then 3 years old



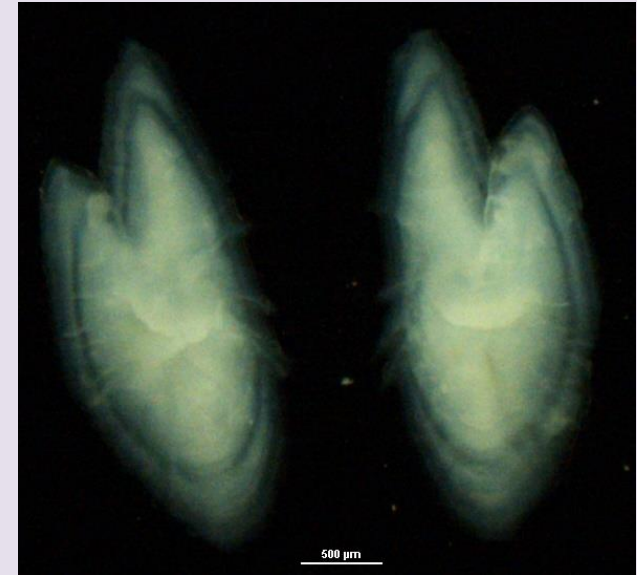
March 16, 2016. n° 71, **162 mm**. 2 years old?. Hyaline edge.  
Rings marked on the rostrum and anti-rostrum.  
Little estimated growth then false ring: **spawning ring C 15**



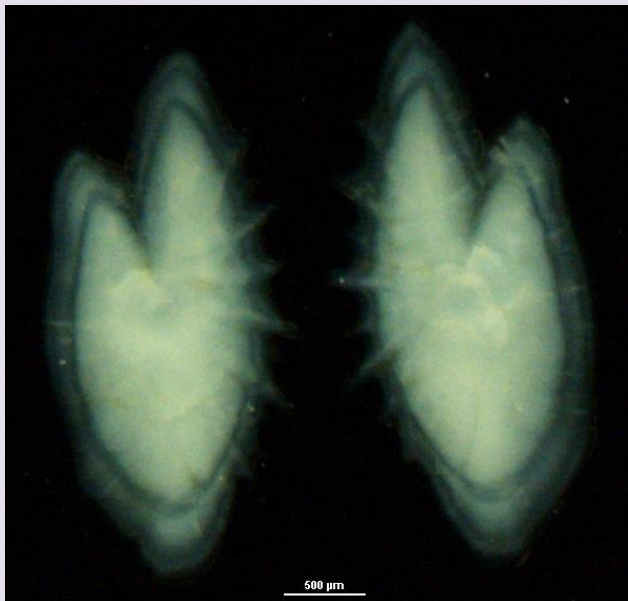
## VIIIc East. 2 or 3 years old?



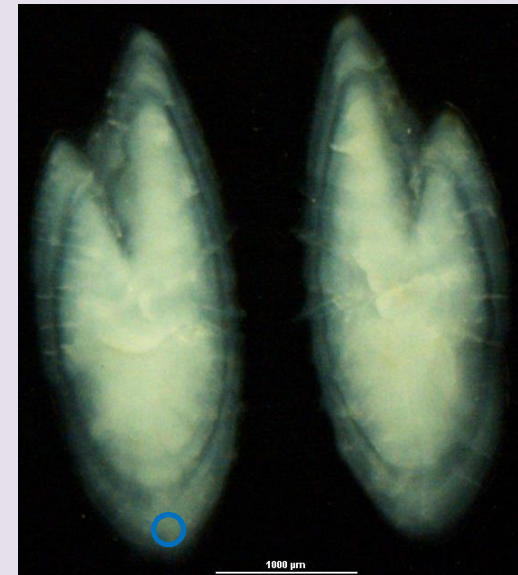
March 16, 2016  
n°21 **161 mm.**  
Hyaline edge  
2 or 3 years old?  
" 1st annual triple winter ring + spawning ring C15  
" 1st annual double winter ring + **spawning ring C 15?** + 2nd marked annual ring and edge.



March 16, 2016. n°32, **153 mm.** Hyaline edge. 2 or 3 years old?  
" 1st annual ring marked and weak spawning ring C 15 + 2° ring + edge  
" 2nd annual ring marked, because estimated growth or spawning ring C 15



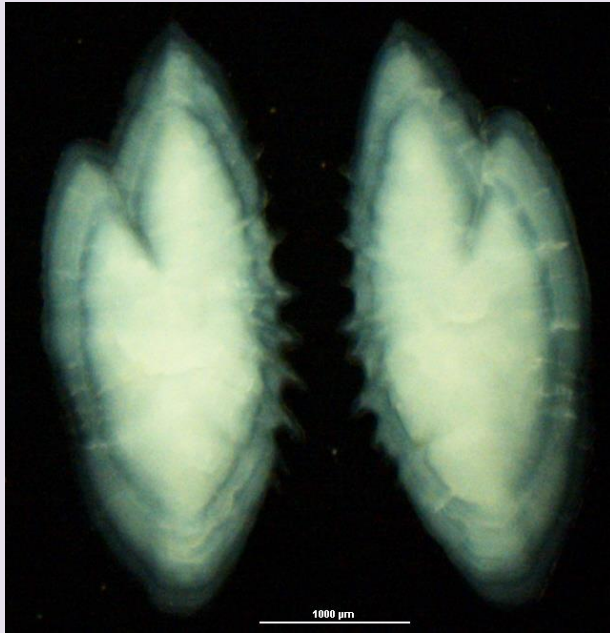
March 16, 2016  
n° 44 ,**157 mm.**  
Hyaline edge. 3 years old  
" 1st annual winter ring + 2nd annual ring + edge.  
Because esteemed pattern of growth.  
" Why not is it, 2nd ring maybe spawning ring C 18?  
Is it because large otolith size ?



March 16, 2016. n° 50, **168 mm.** Hyaline edge. 2 or 3 years old?  
" 2nd real ring or **spawning ring C 18?**

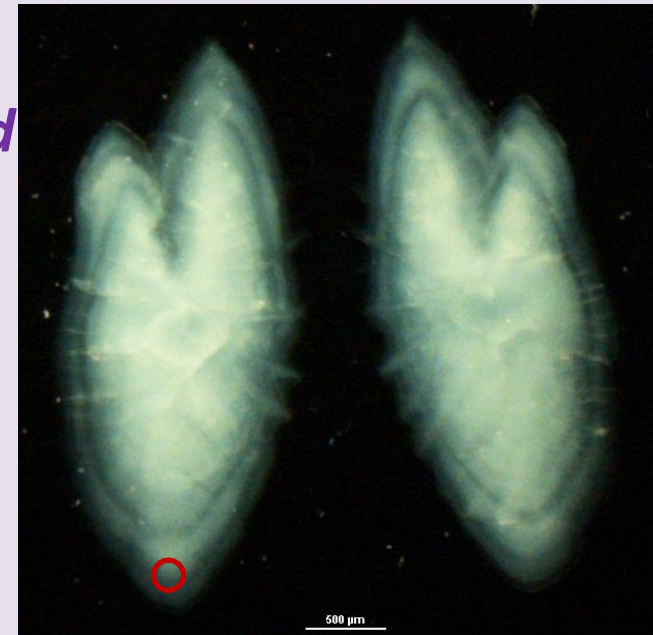
## VIIIc East

### 2 against 3 years old

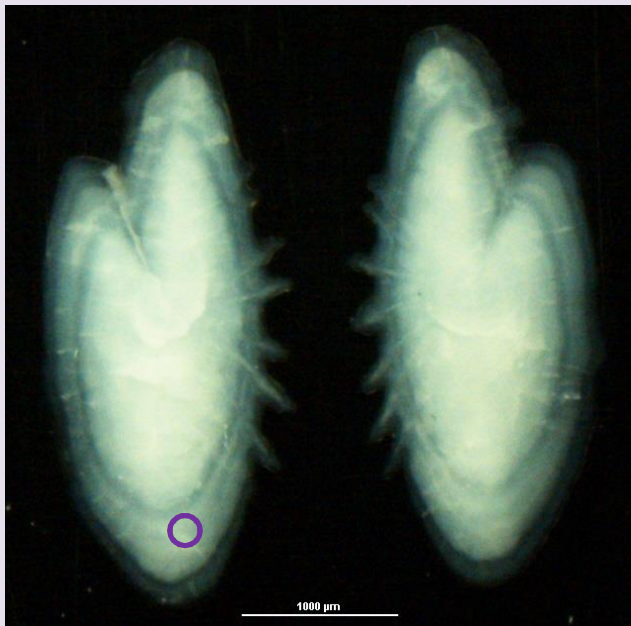


March 16, 2016  
n° 89, **172 mm**  
Hyaline edge. 3 years old.

Good example of annual rings with expected growth

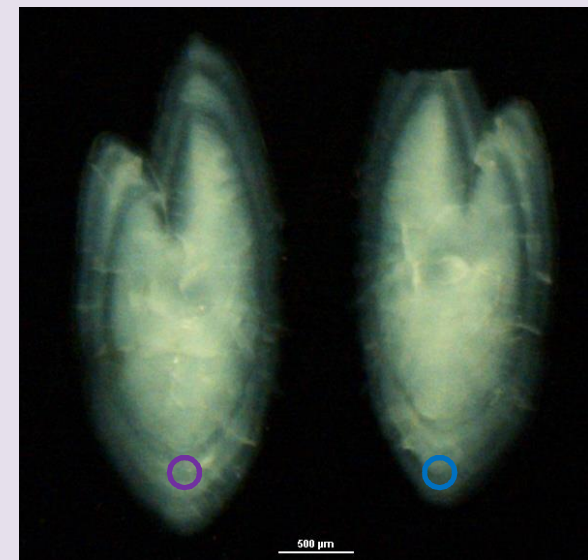


March 16, 2016. n° 96, **165 mm** . Hyaline edge. 2 years old  
**Spawning ring C 15** because little growth?



March 16, 2016.  
n° 90 **163 mm**  
Hyaline edge. 3 years old.

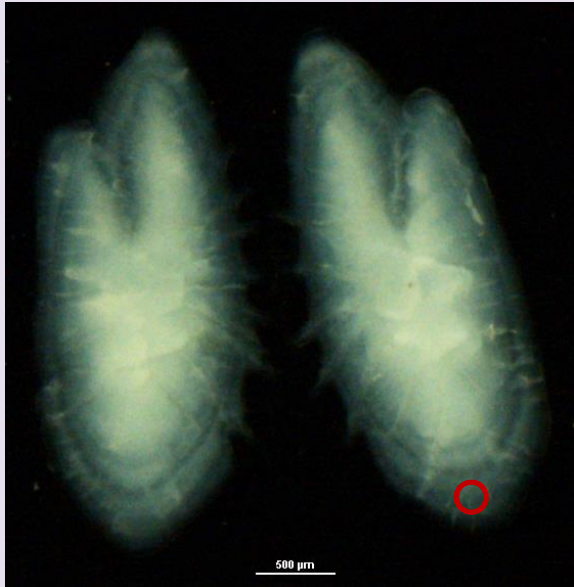
1st winter ring +  
weak **spawning ring C 12**  
+ 2nd annual ring + edge



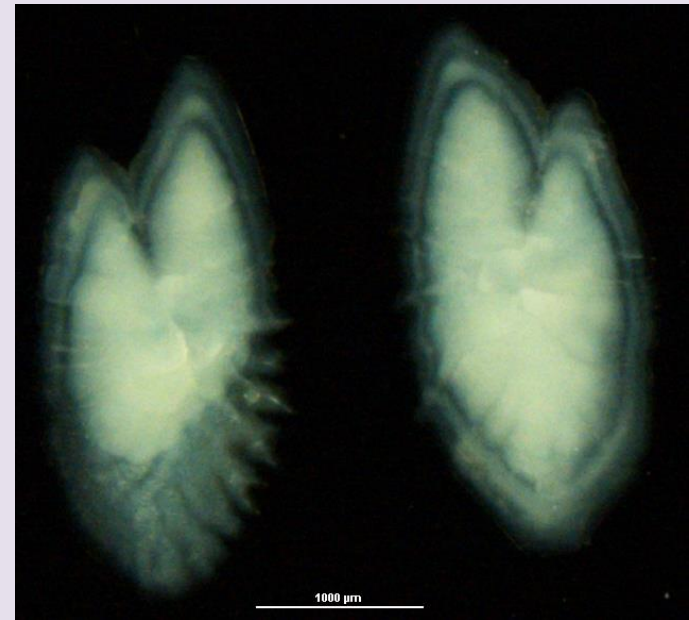
March 16, 2016. N° 51, **161 mm**. Hyaline edge. 2 or 3 years old?  
**Spawning ring C 12** or **spawning ring C 18**? What does it depend on?



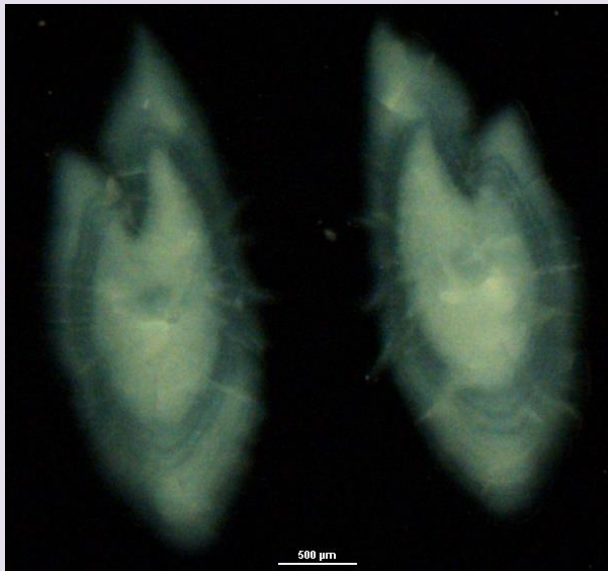
## VIIIc East Real or false rings?



March 16, 2016.  
n° 12, **156mm**  
Hyaline edge. 2 years old  
1st annual double winter ring  
+ **spawning ring C15**



March 16, 2016. n° 14, **162mm**. Hyaline edge. 2 years old  
Spawning ring C 15 because, is it little growth for annual ring? Or 3 years old?

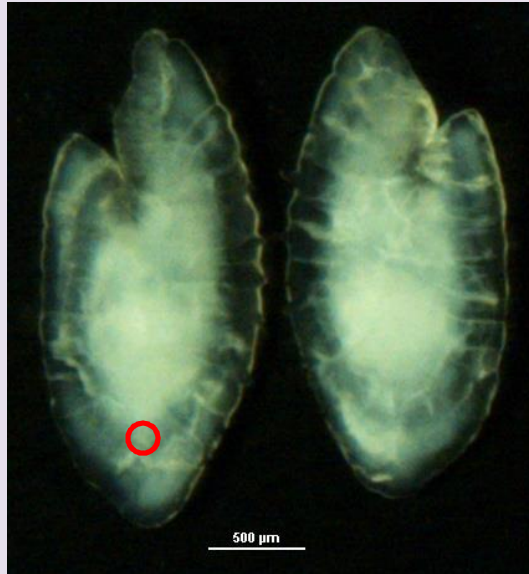


March 16, 2016  
n°28, **163mm**  
Hyaline edge. 2 years old  
" 1st annual triple winter ring  
" No 1st + 2nd + 3rd ring  
independent?

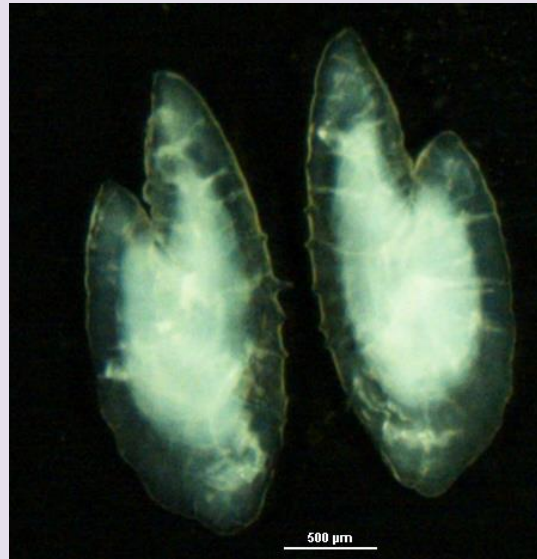


March 16, 2016. n° 29, **159mm**. Hyaline edge. 2 years old.  
**Spawning ring C 15**. Rings marked on the rostrum.

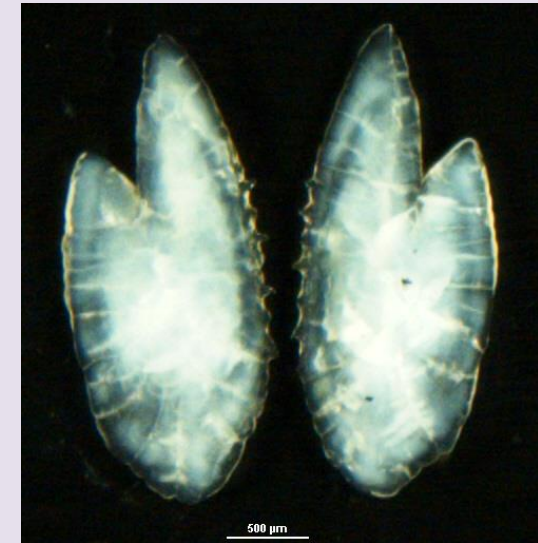
*VIIIc East. False checks previous to the 1st winter hyaline zone: measure*



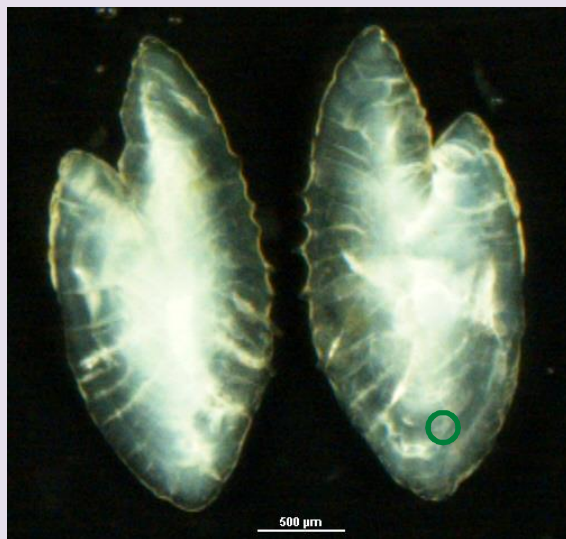
L131, nº38 , **96 mm**. 0 year old  
Central check C 08: R1 741,43 µm



L129, nº22, **106 mm**. 0 year old  
Central check C 08: 790,68 µm

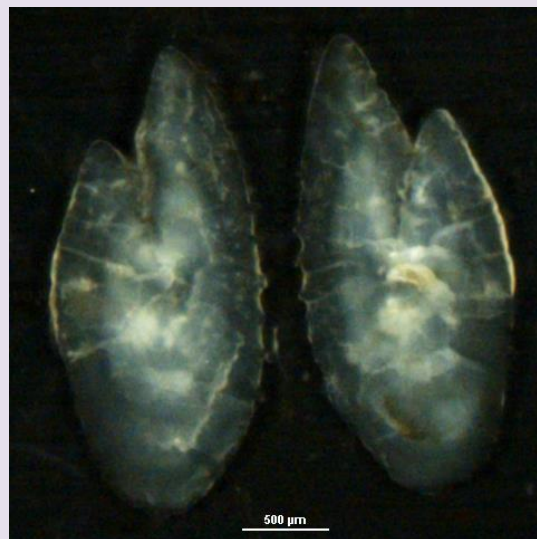


L94, nº11, **114 mm**. 0 year old  
Central check C 08: 887,66 µm



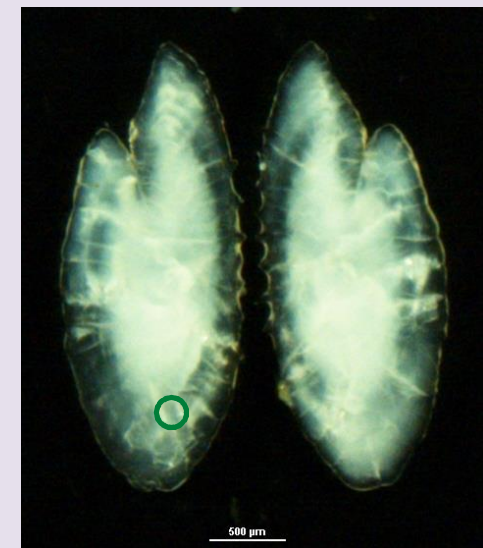
L129, nº12, **104 mm**. 1 year old  
Although small size.  
Annual ring R1: 907,11 µm

October. DEMERSALES2016



L94, nº 3, **116 mm**. 1 year old  
Central check C 08: R1 715,58 µm

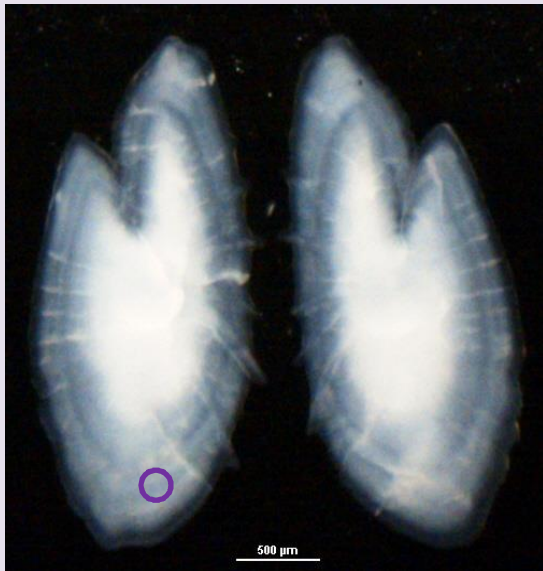
October. DEMERSALES2016



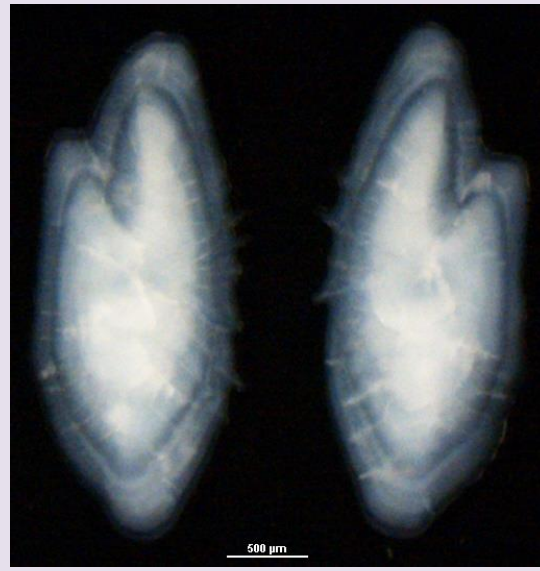
L131, nº 36, **115 mm**. 1 year old  
Annual ring : R1 923,48 µm



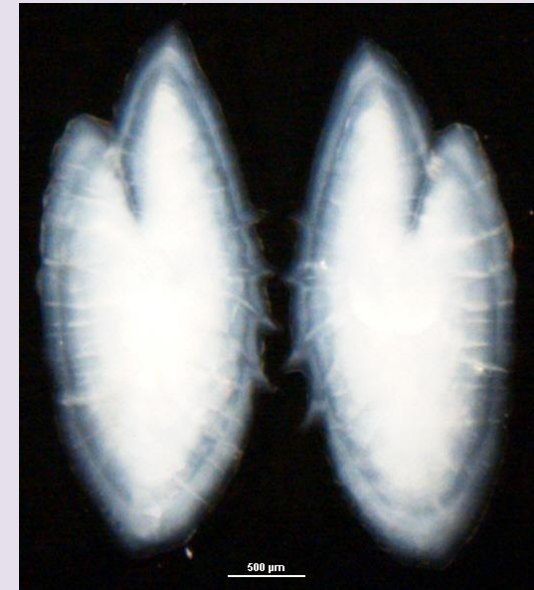
## VIIIc East: Common checks appear during the 2nd year of life



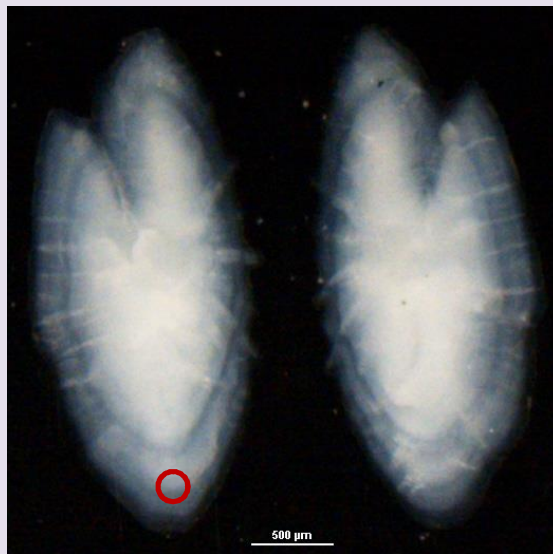
May 5, 2016. nº 80, **132mm**  
2 years old. **Spawning ring C 12**



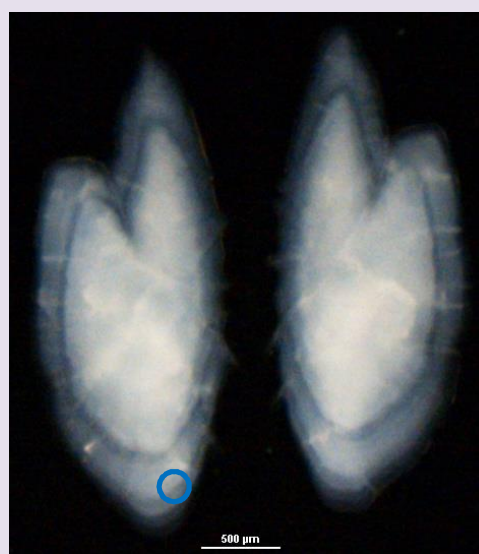
May 5, 2016. nº 55, **138mm**  
2 years old. Spawning ring C 12



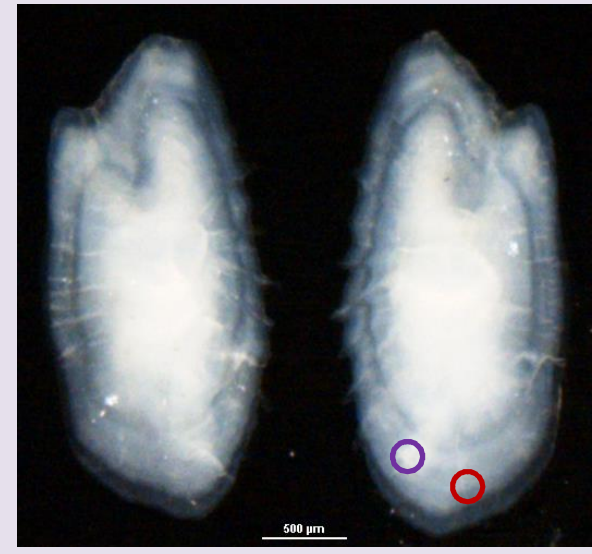
May 5, 2016. nº 76, **139mm**  
2 years old. Weak spawning ring C 12



May 5, 2016. nº32, **139mm**  
2 years old. **Spawning ring C 15**

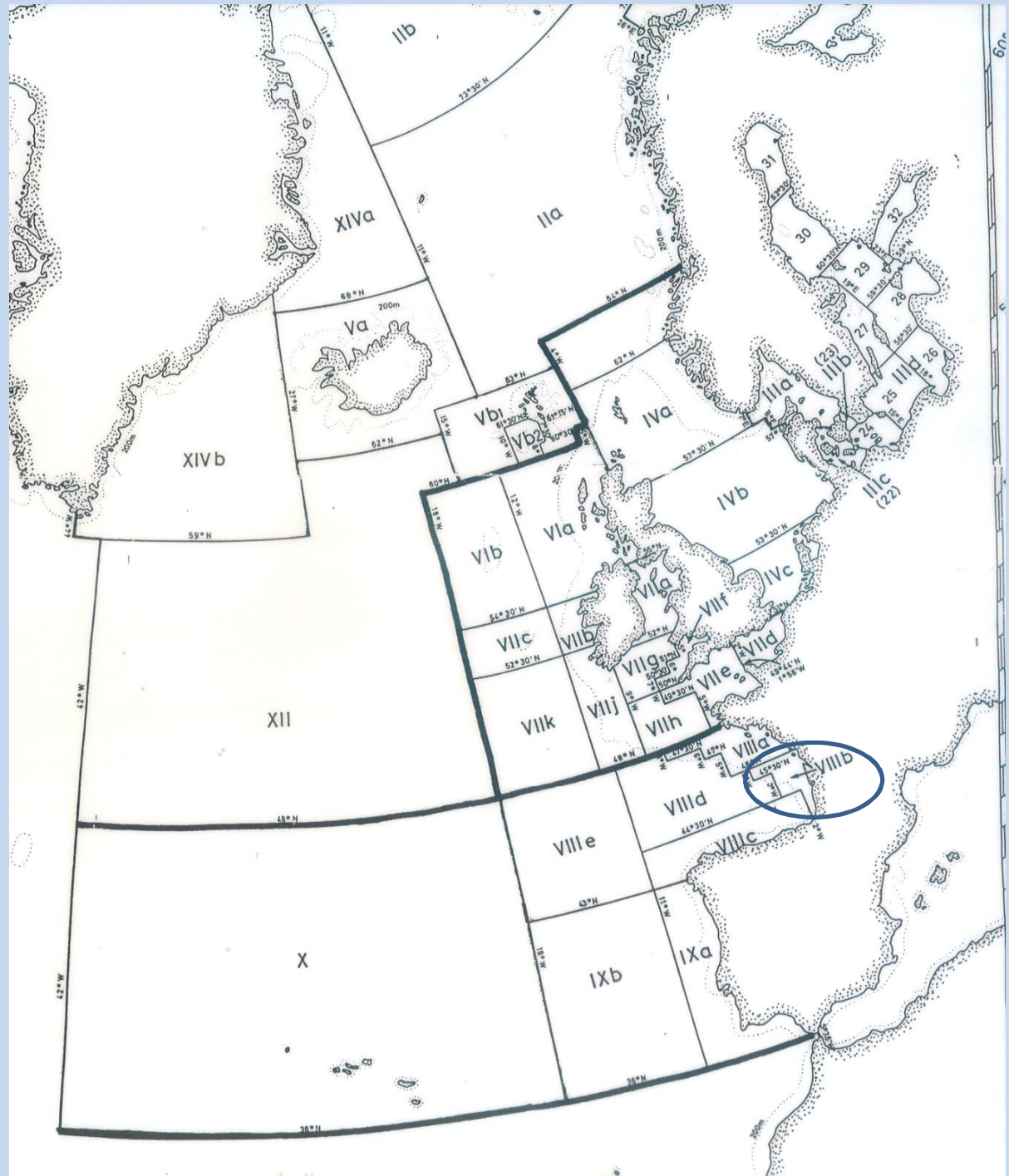


May 5, 2016. nº 37, **138mm**  
2 years old. **Spawning ring C 18**



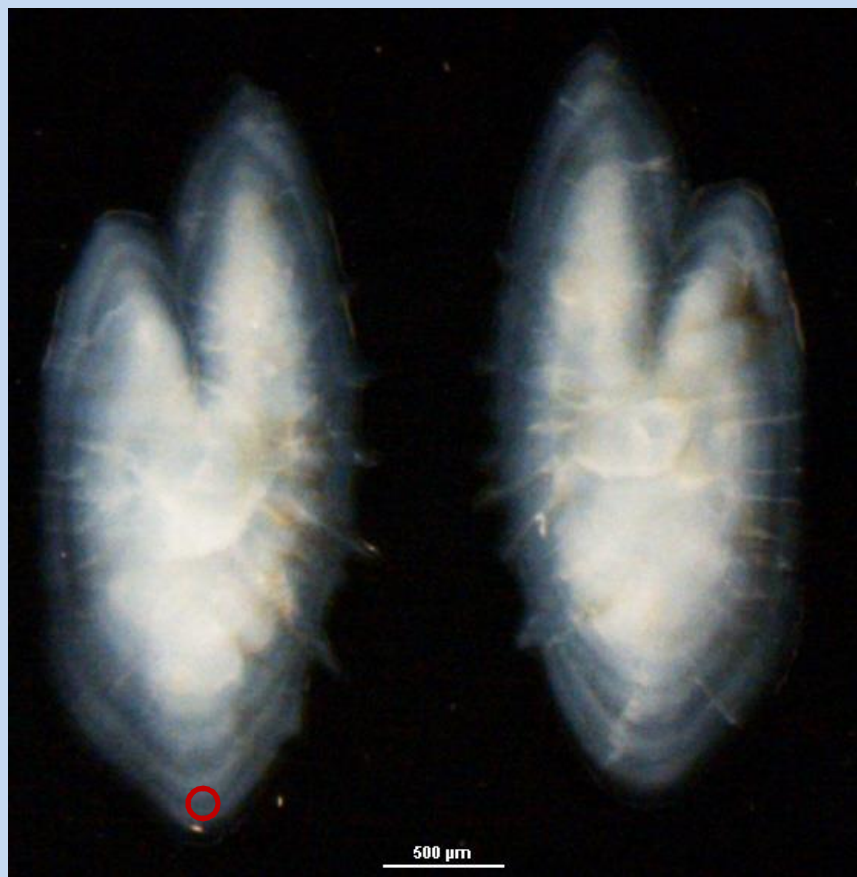
May 5, 2016. nº 51, **136mm**  
2 years old. Weak spawning rings **C12** and **C15**

**ICES**  
**Division**  
**VIIIb**

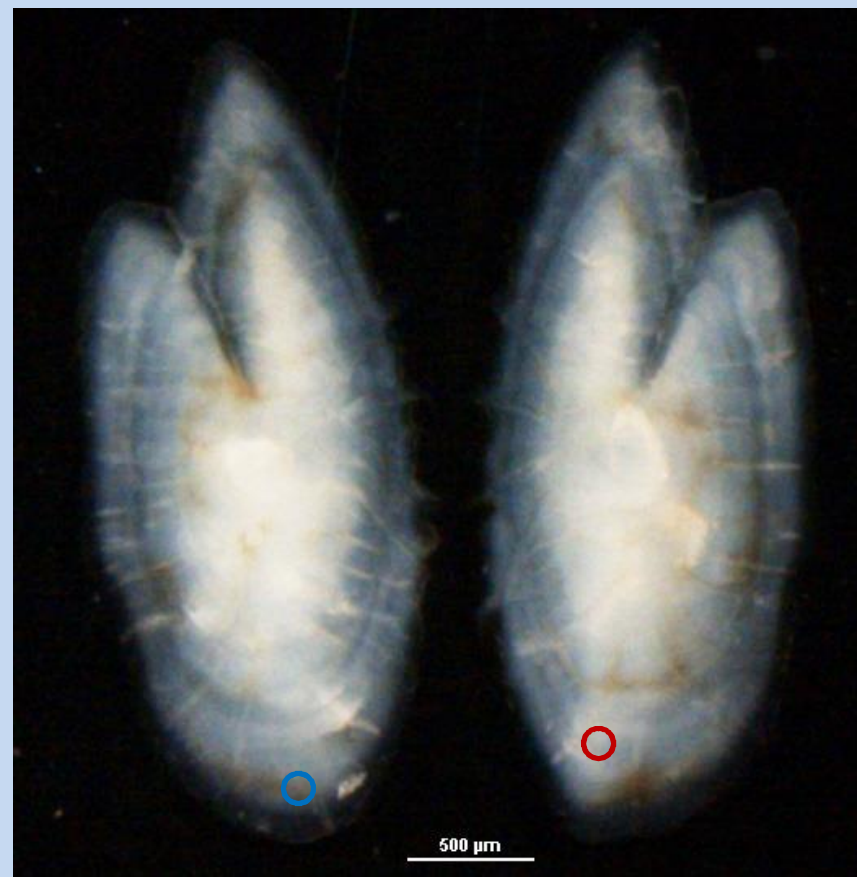




## VIIIb. What rings do we take into account?



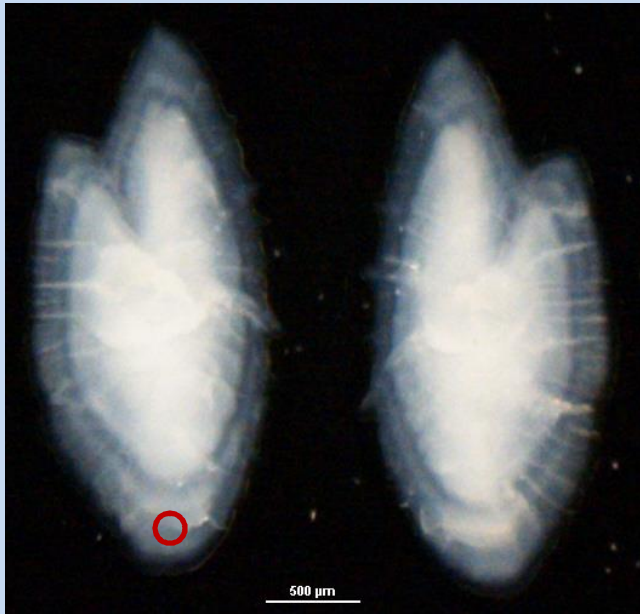
April 25, 2016  
Nº 23, **132 mm**  
1st annual double winter ring +  
**Spawning check C 15**  
Hyaline edge. 2 years old



April 25, 2016  
Nº 93, **133 mm**  
1st annual triple ring of winter +  
Spawning checks **C 15** and **C 18**  
Hyaline edge. 2 years old

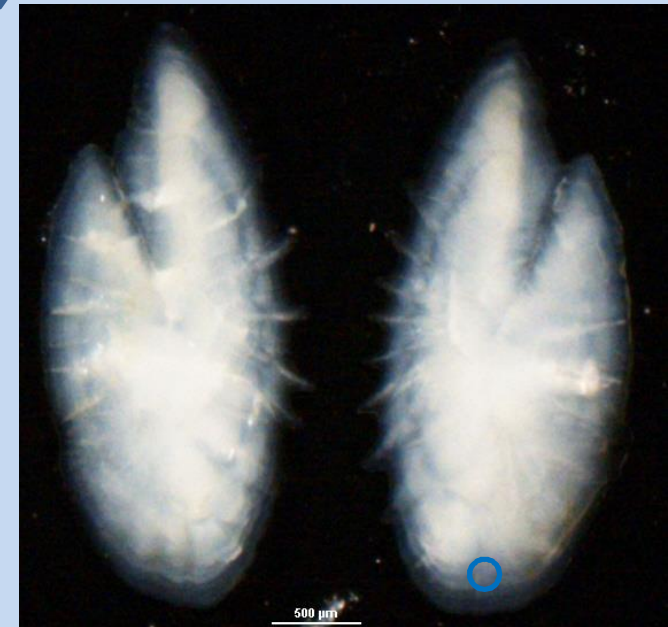


## VIIIb: Common checks appear during the 2nd year

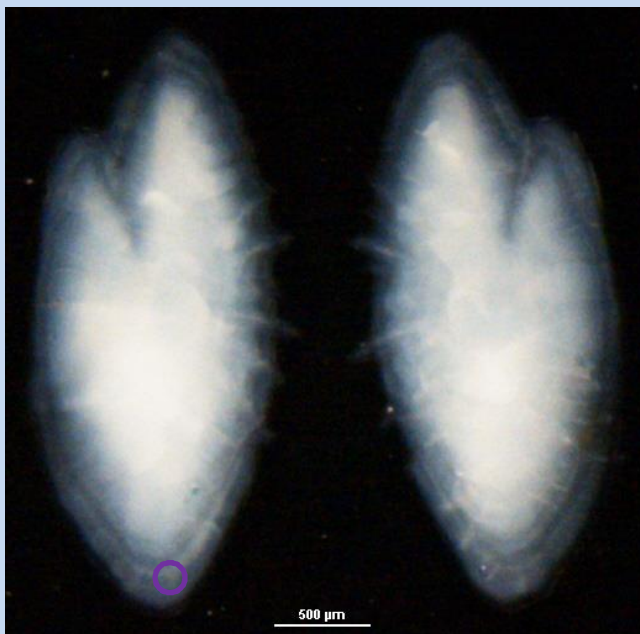


April 25, 2016  
N°28, 138 mm

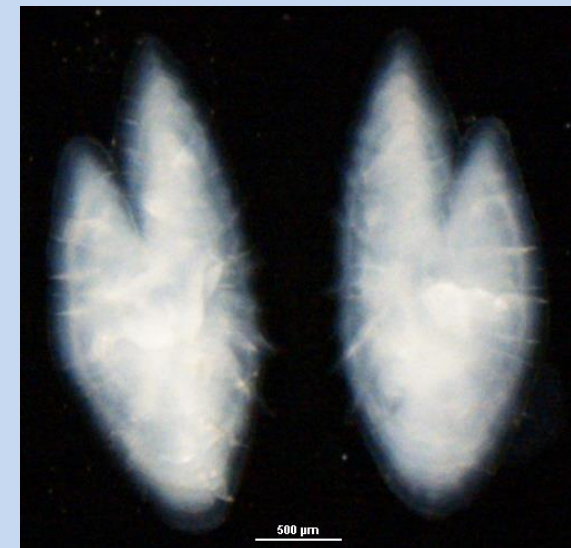
1st annual ring marked +  
weak **spawning ring C 15** +  
hyaline edge  
2 years old



April 25, 2016. n°66, 136 mm. Hyaline edge. 2 years old  
1st weak annual ring ( R1 1004,44 µm )+ **spawning ring C 18**



April 25, 2016  
N°90, 131 mm  
1st annual double ring +  
**Spawning ring C 12** +  
Hyaline edge  
2 years old



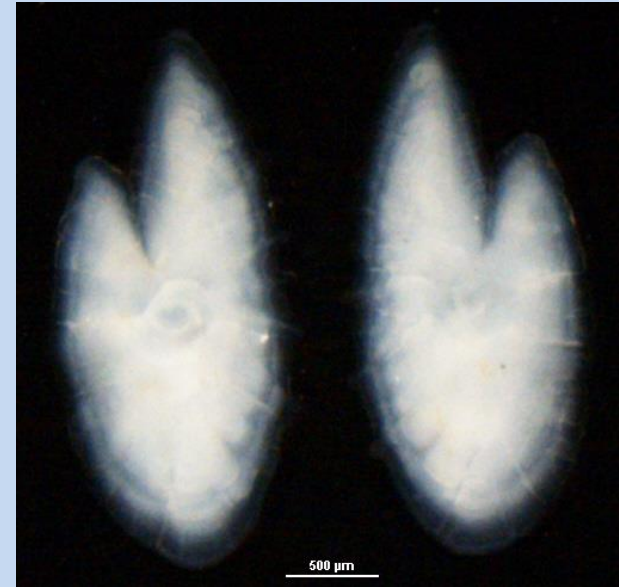
April 25, 2016. N° 98, 131 mm. Hyaline edge. 1 year old  
1st weak annual ring (R1 927,21 µm). We do not count for small size?

## VIIIb. Little visible rings

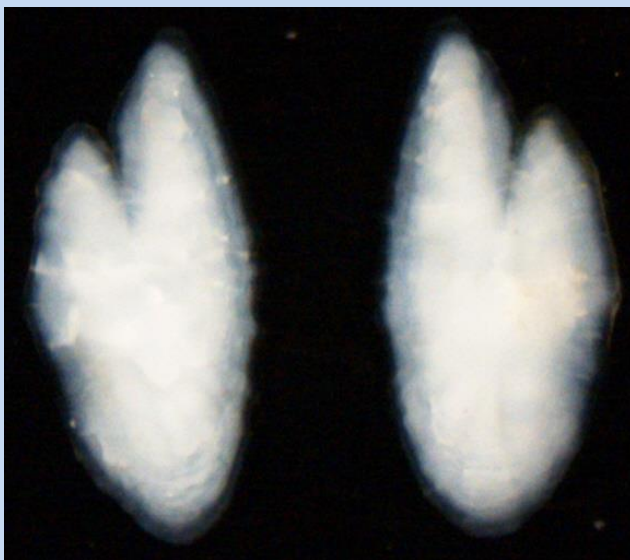
*When do we take  
into account?*



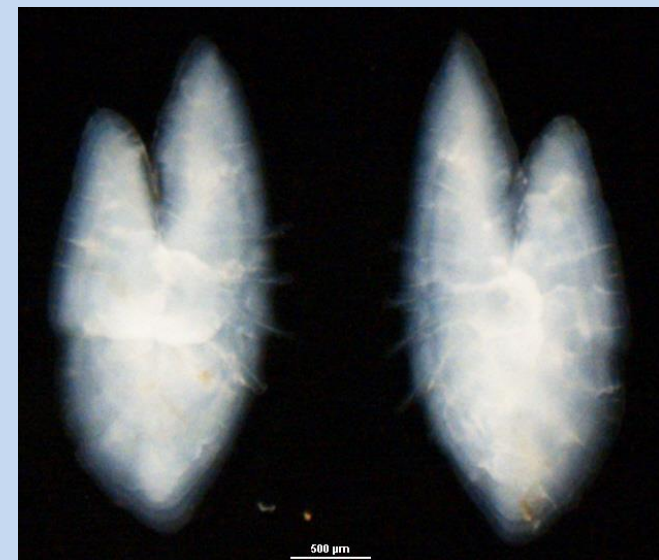
April 25, 2016  
Nº 64, **138 mm**  
Hyaline edge  
1 year old  
Weak central ring  
When the ring is taken  
Into account ?



April 25, 2016. Nº82 , **128 mm**. Hyaline edge  
1 year old . Weak central ring and little growth ?



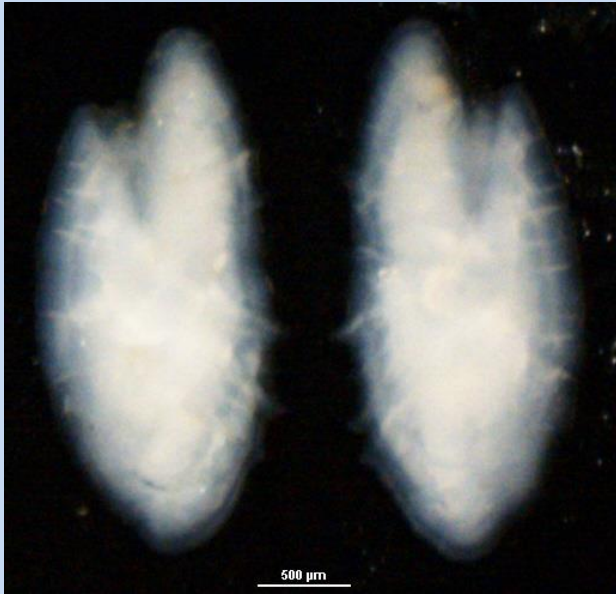
April 25, 2016  
Nº 68, **148 mm**  
Hyaline edge  
1 year old  
Weak central ring



April 25, 2016. Nº 92, **148 mm**. Hyaline edge  
2 years old. Weak central check with expected growth ?



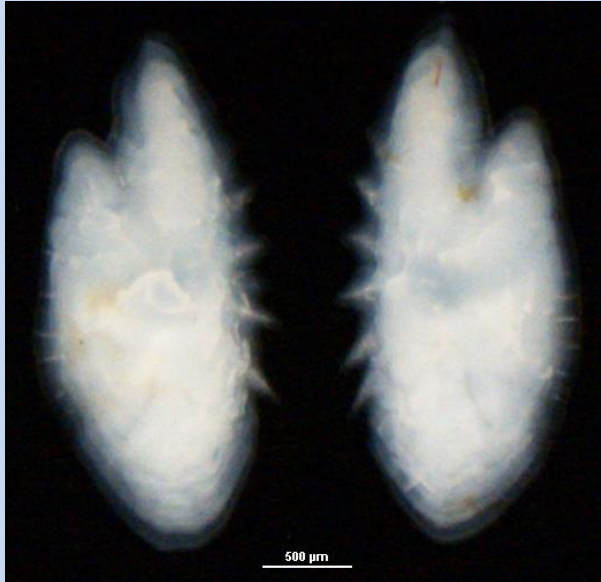
*VIIIb. Little visible rings*  
*When do we take into account?*



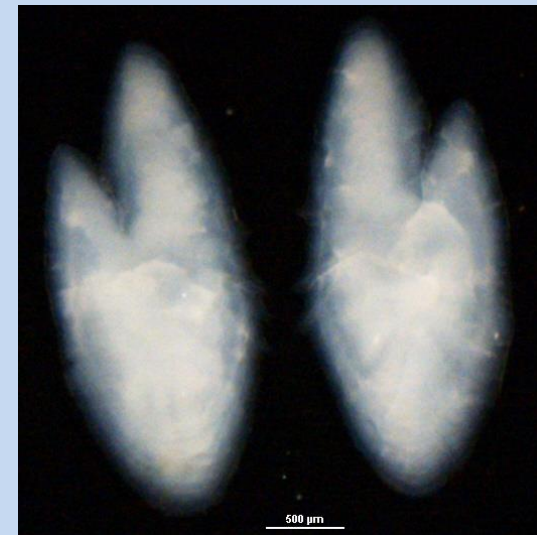
April 25, 2016  
Nº 65, **146 mm**  
Small opaque edge at bases.  
1 year old.  
Weak annual ring



April 20, 2016. Nº 93, **145 mm**. Hyaline edge.  
2 years old. Weak annual ring with expected growth



April 20, 2016  
Nº 95, **153 mm**  
Small opaque edge at bases.  
2 years old  
Weak split rings



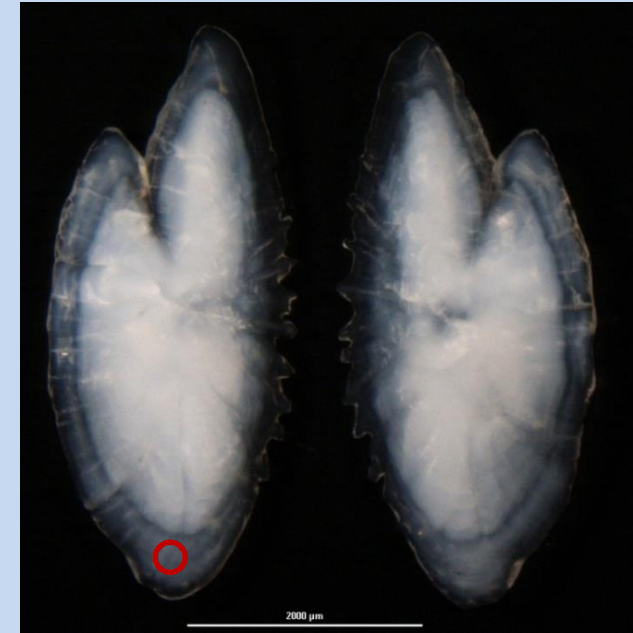
April 20, 2016. Nº 100, **138 mm**. Hyaline edge. 2 years old  
Weak annual ring with expected growth



## VIIIb Special otoliths to show



January 20, 2016. nº1, 165 mm. Hyaline edge . 2 years old  
1st annual double winter ring.



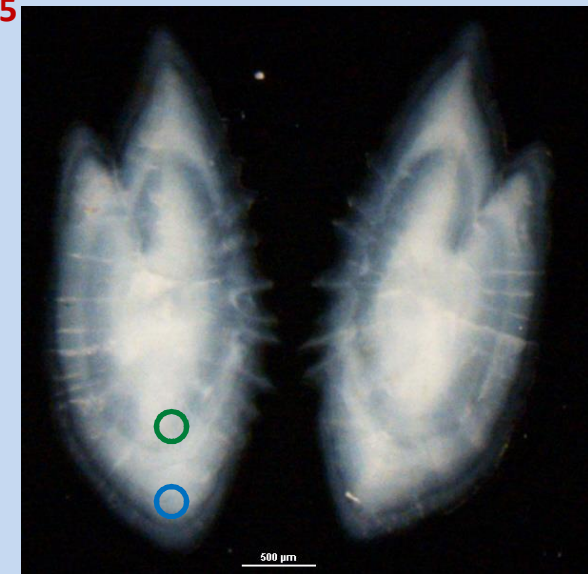
January 20, 2016. nº 2, 181 mm. Hyaline edge. 2 years old  
**Spawning ring C 15**



April 25, 2016  
Nº 32, 156 mm  
Hyaline edge.  
**Central check C 08:** R1 800,90 µm  
+ 1st annual double winter ring + :

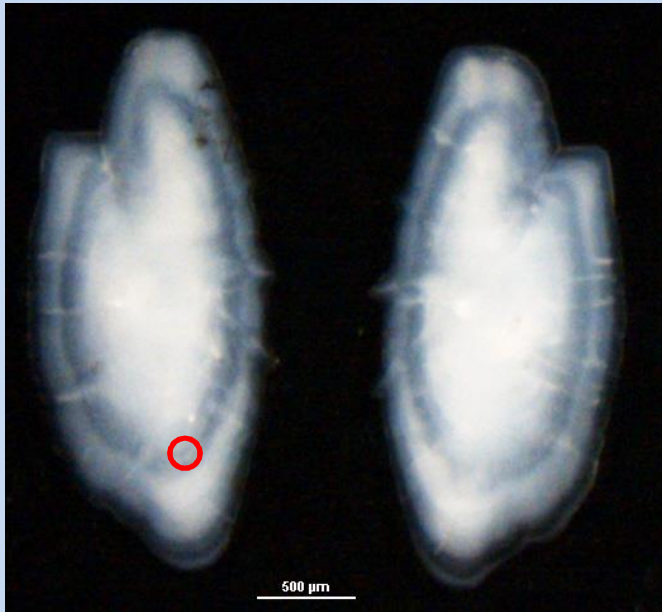
“ 2nd annual ring marked +  
hyaline edge ? 3 years old

“ Or spawning ring C 18 + hyaline  
edge ? 2 years old



April 25, 2016. Nº 86, 163 mm. Hyaline edge. 3 years old.  
1st **annual winter ring**: R1 953,46 µm. Weak **spawning ring C 18**

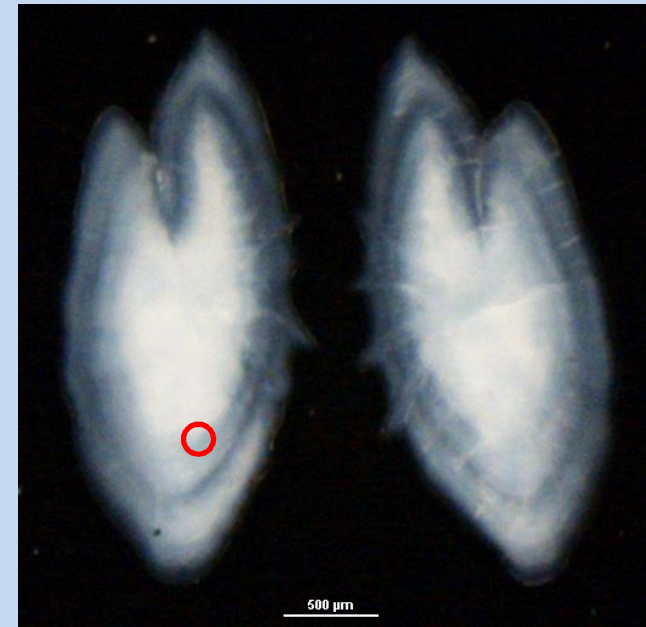
## VIIIb. Different types of checks



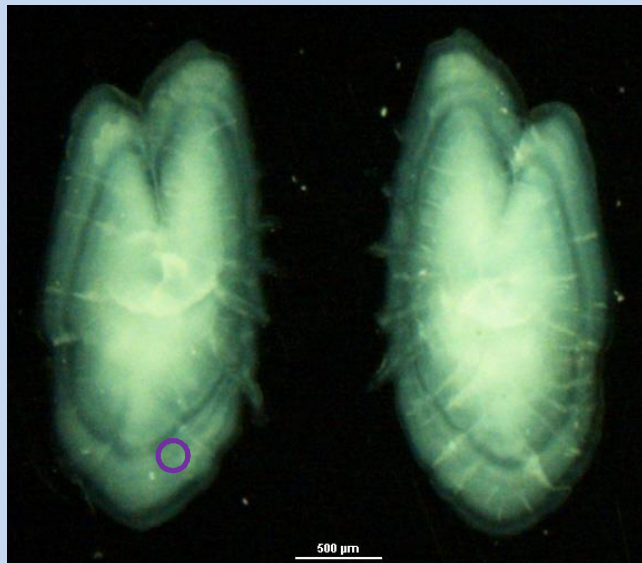
May 17, 2016. n°39, **127 mm**  
Opaque edge. 1 year old

Apparently winter annual  
ring, but when measuring its  
radius: R1 745,82 µm

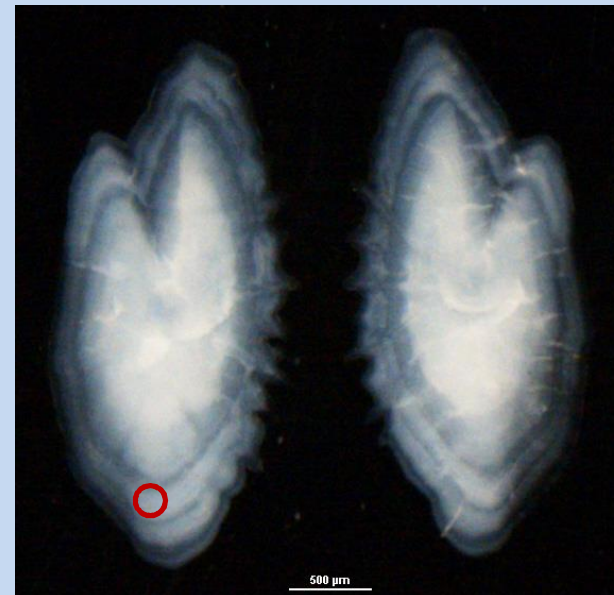
**Check central C 08**



May 17, 2016. n° 76, **123 mm**. 2 years old  
Weak **check central C 08**: R1 743,35 µm



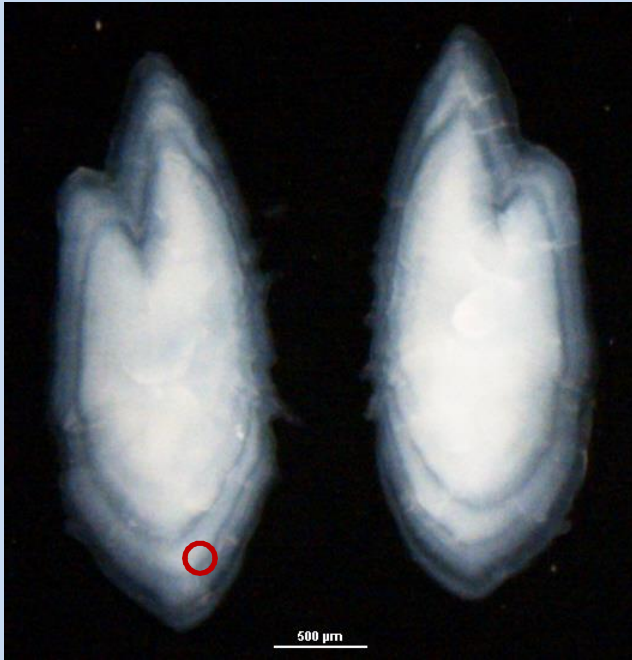
May 17, 2016  
n°36, **122 mm**  
Opaque edge.  
2 years old  
**Spawning ring C 12**



May 17, 2016  
N°94, **126 mm**  
Opaque edge  
2 years old  
**Spawning ring C 15**



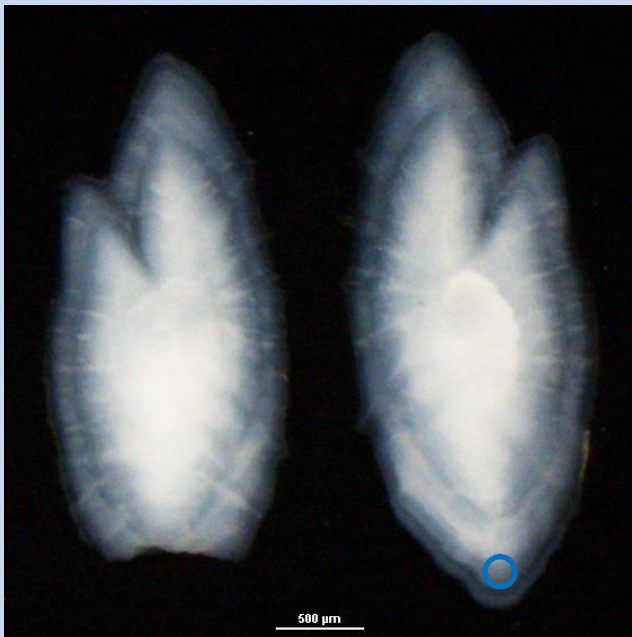
## VIIIb. Different types of checks



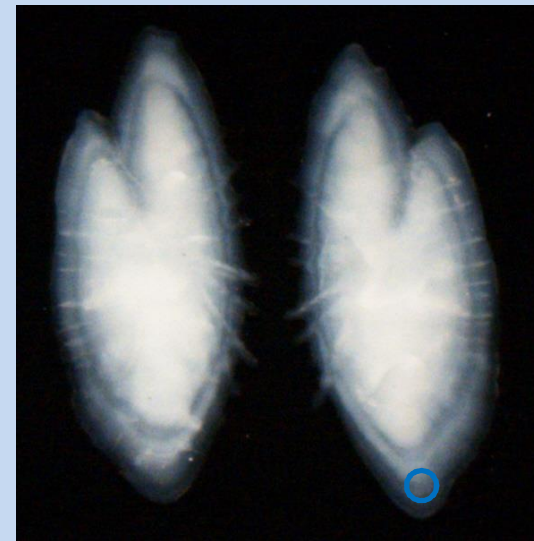
May 17, 2016  
n° 55, 125 mm  
Opaque edge  
2 years old  
**Spawning ring C 15**



May 17, 2016. n°74, 125 mm  
Hyaline edge. 2 years old  
**Spawning ring C 15**



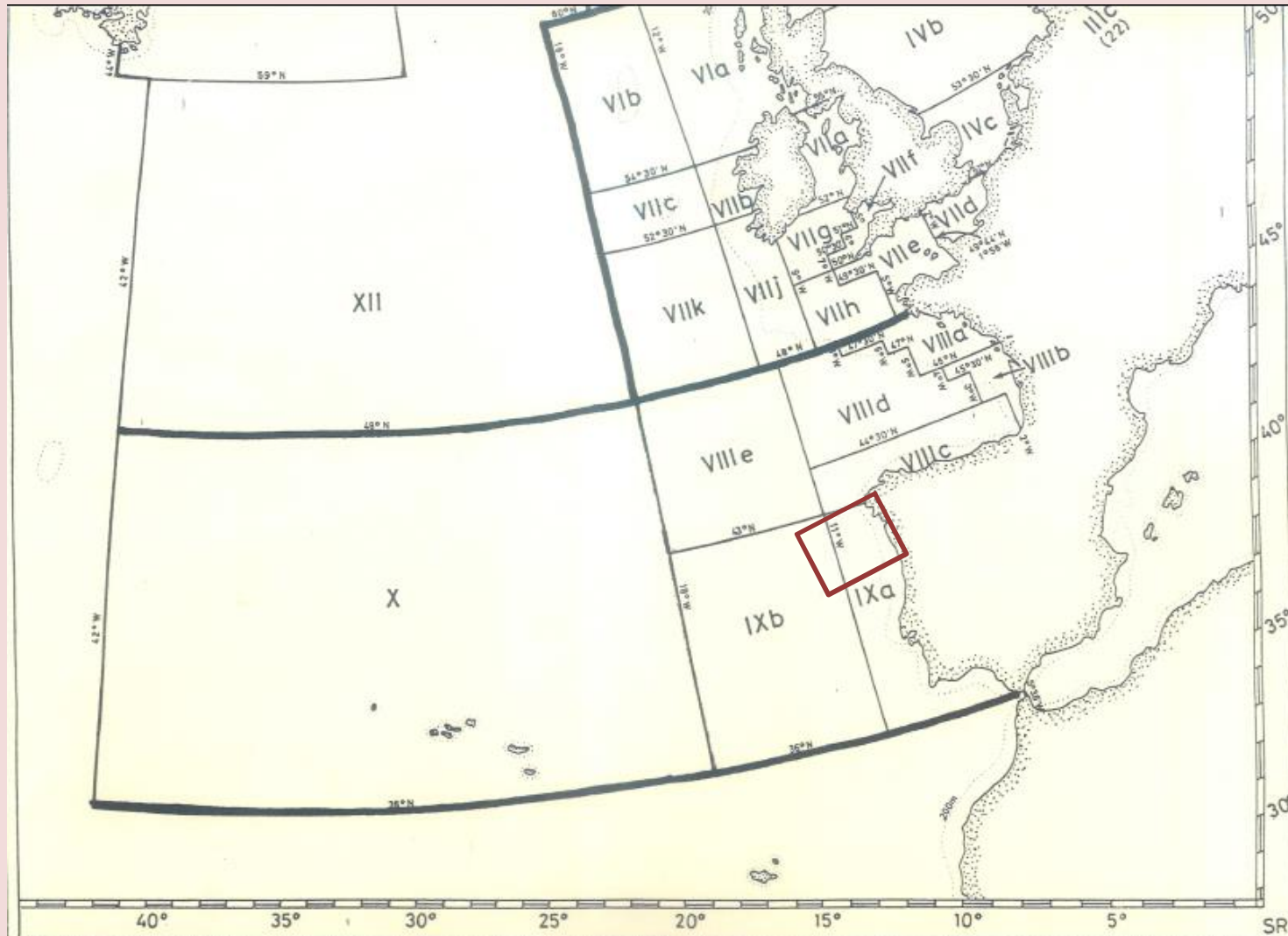
May 17, 2016  
n°11, 128 mm  
Opaque edge  
2 years old  
Weak **spawning ring C 18**



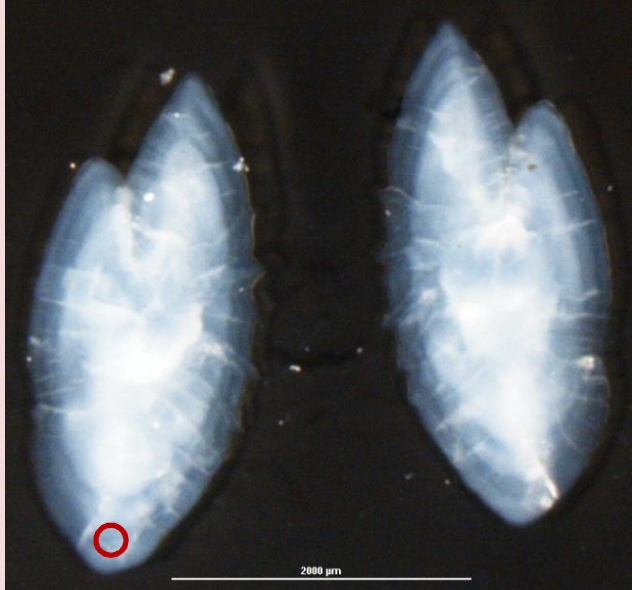
May 17, 2016. n° 66, 130 mm. Opaque edge.  
2 years old. Weak **spawning ring C 18**



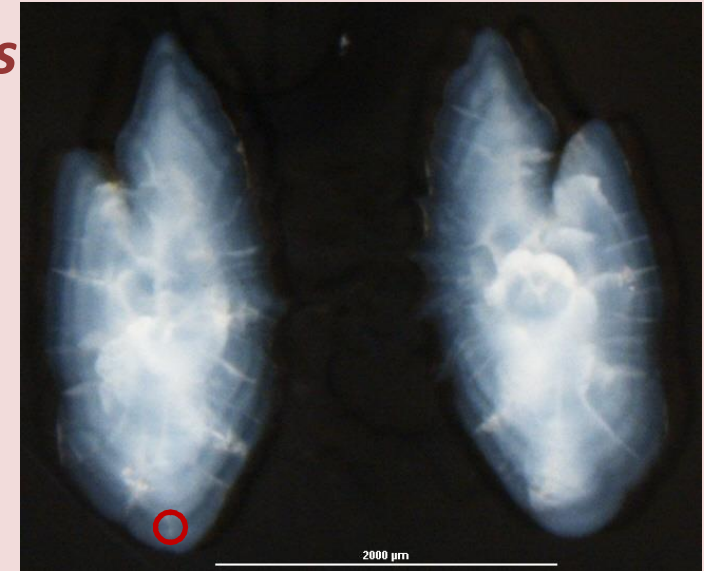
# *ICES Sub-division Ixa North*



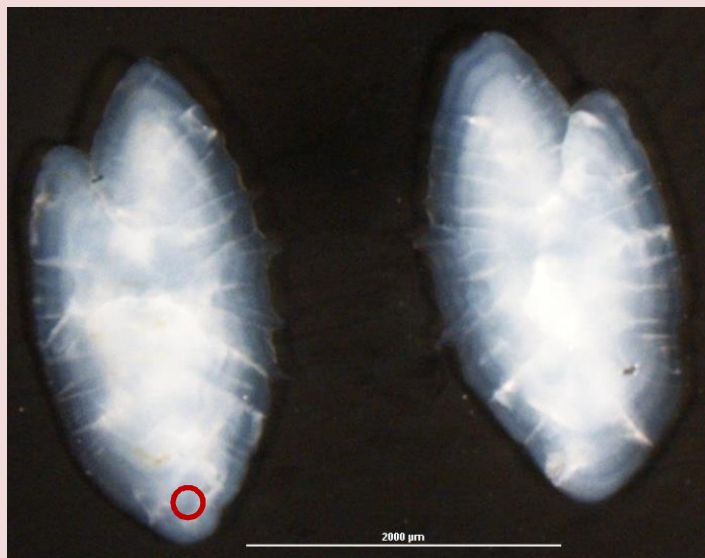
## *Ixa North* Overmarked checks



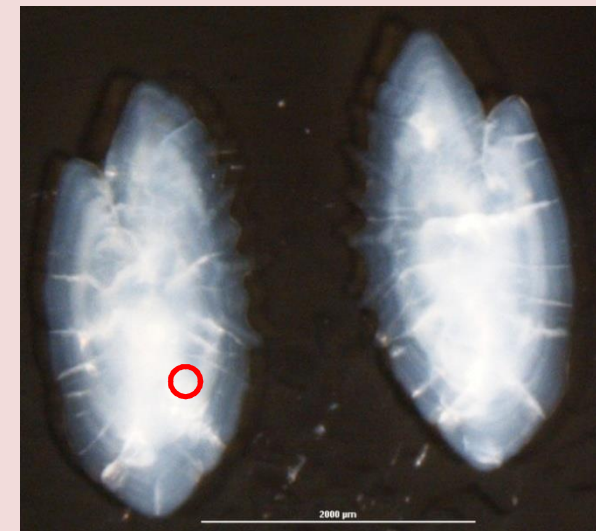
March 16, 2016 n° 3, **111 mm**  
Opaque edge  
1 year old  
1st annual winter ring  
(R1 1188,35 µm) +  
Wide **spawning ring C 15**  
very marked



March 16, 2016. n°42, **106 mm**. Opaque edge. 1 year old  
1st annual winter ring (R1 1055,42 µm) + wide double  
**spawning ring C 15** very marked

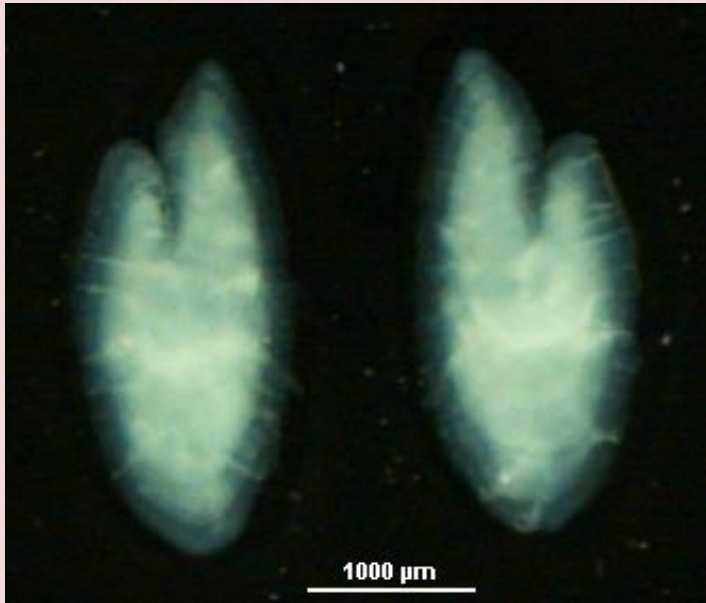


March 16, 2016  
n° 81, **107 mm**  
Opaque edge.  
1 year old  
1st annual winter ring  
(R1 1147,85 µm) +  
**Spawning ring C 15** very  
marked

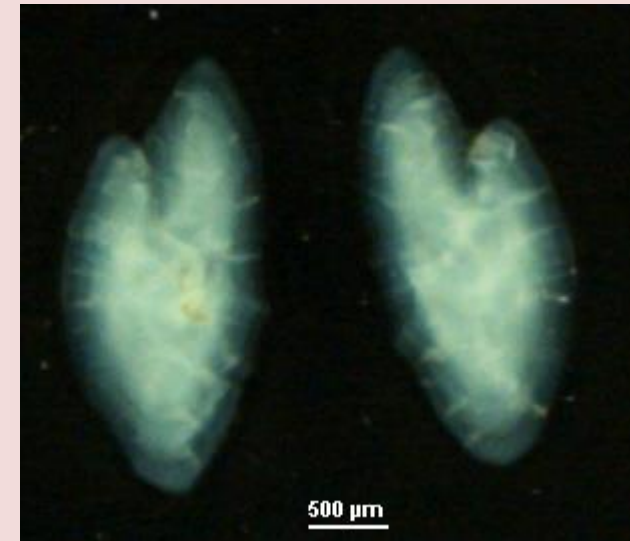


March 16, 2016. N° 99, **106 mm**. Opaque edge. 1 year old  
**Check central C 05** ( R1 600,64 µm) + triple annual winter ring

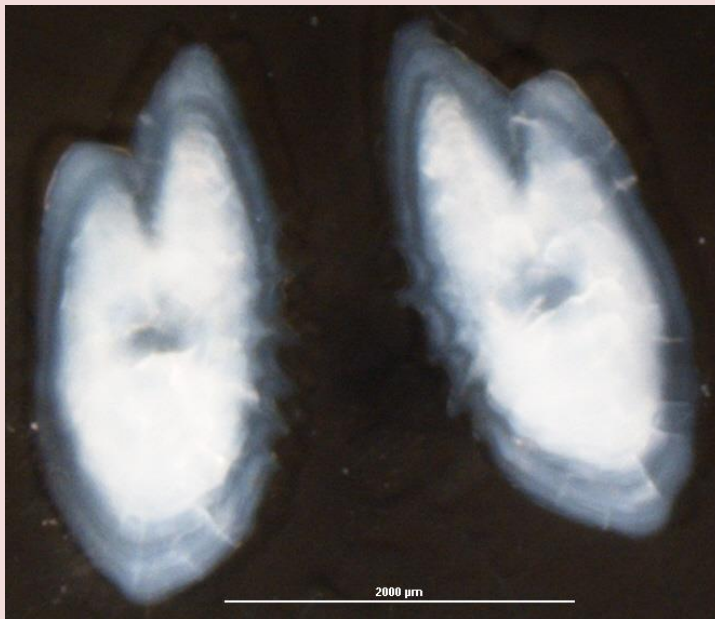
## *Ixa North* *Edge types*



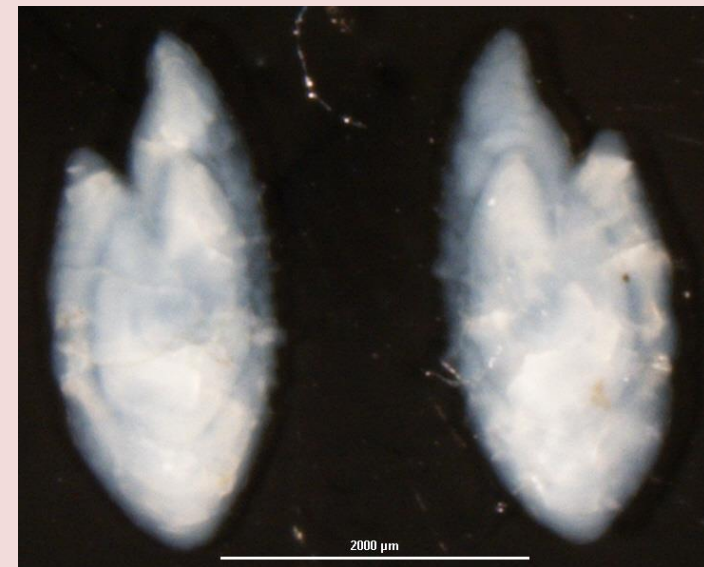
April 21, 2016  
Nº 65, **136 mm**  
Opaque edge  
1 year old  
Is it possible to spawning  
check C 15 more  
marked than the annual  
ring (R1 1020,53  $\mu\text{m}$ ) ?



April 21, 2016. nº 66, **140 mm**. Opaque edge. 1 year old  
Spawning check C 15 more marked than the annual ring (R1 944,27  $\mu\text{m}$ )



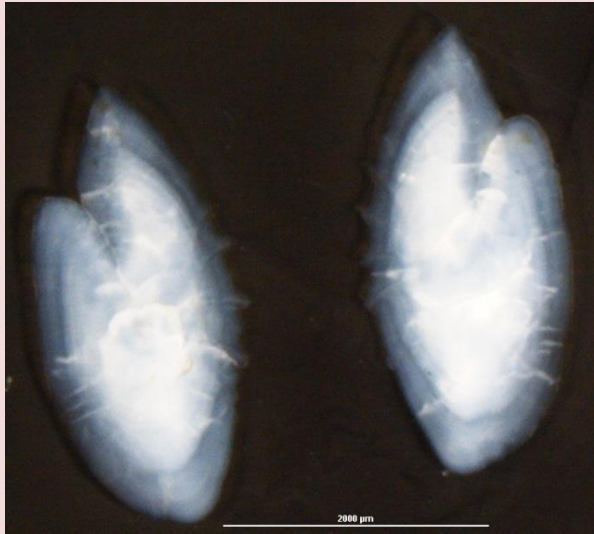
May 10, 2016  
nº 80, **128 mm**  
Opaque edge  
1 year old  
Weak spawning  
Check C 15



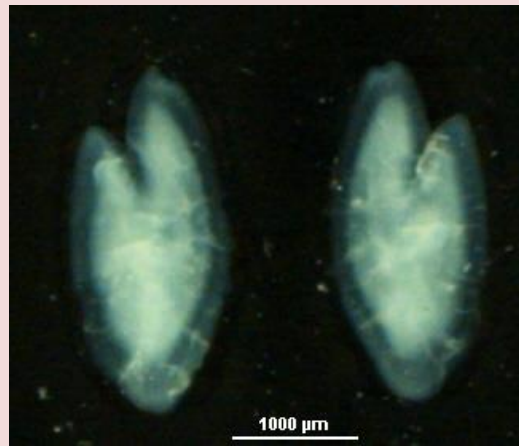
June 22, 2016. Nº7, **125mm**. Hyaline edge. 2 years old  
1st annual winter ring (R1 974,02  $\mu\text{m}$ ) no central check



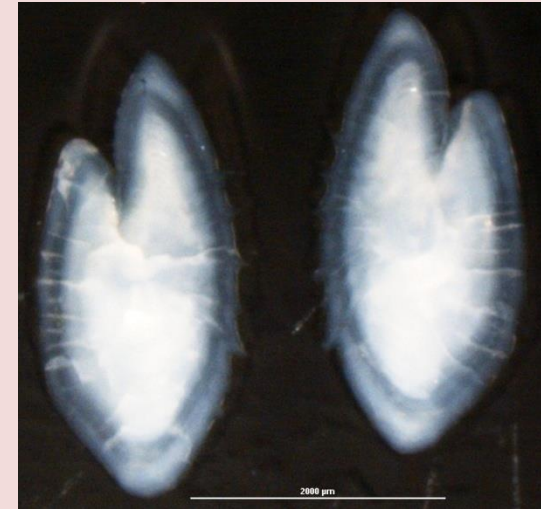
## *Ixa North. Edge types*



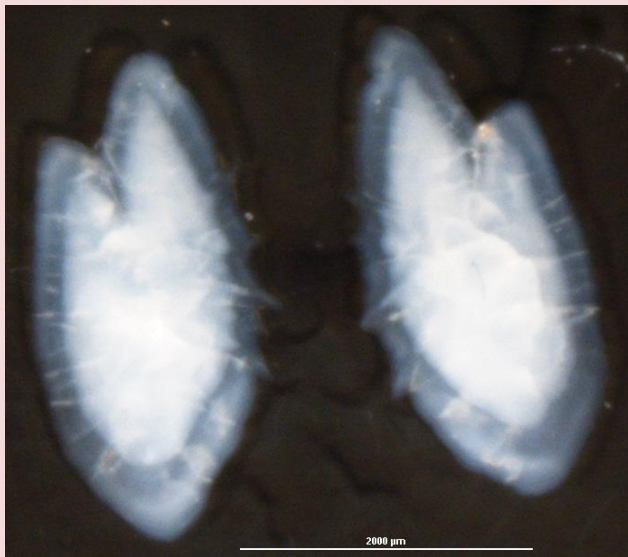
March 16, 2016. Nº 100, **117 mm**. 1 year old  
Weak spawning C 18 . Opaque edge ?



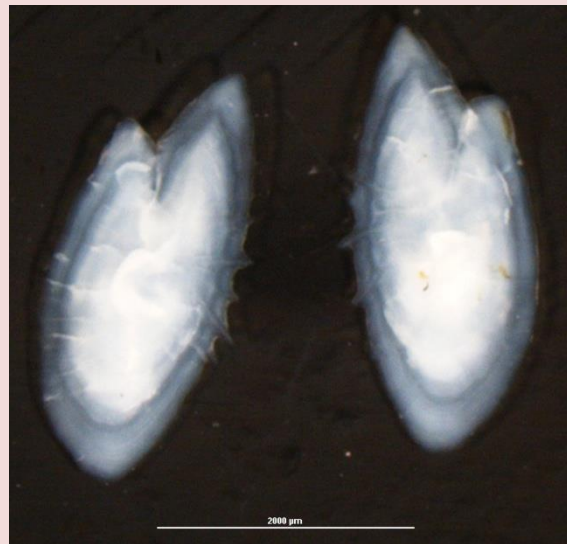
April 21, 2016. Nº 55, **128 mm**  
1 year old. Opaque edge?



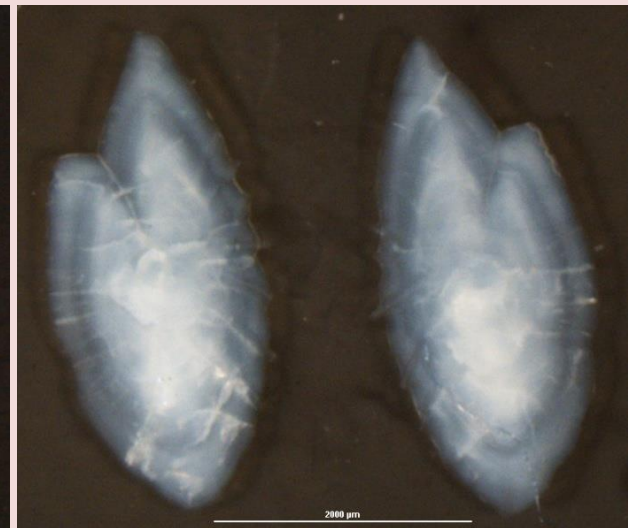
May 10, 2016. Nº49, **126 mm**  
1 year old. Opaque edge?



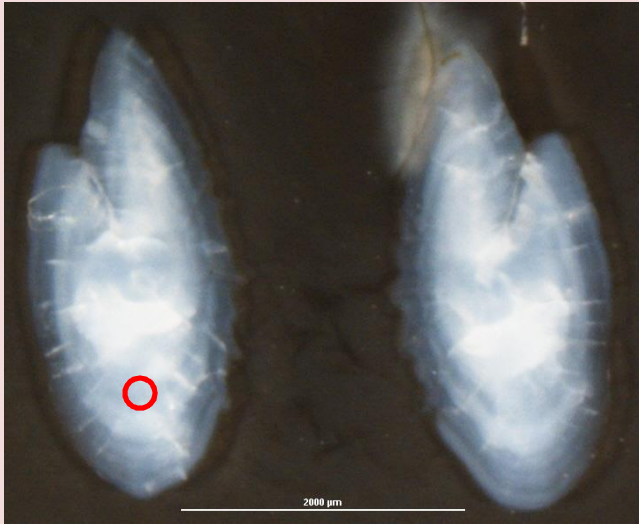
May 10, 2016. Nº94, **125 mm**  
1 year old. Opaque edge?



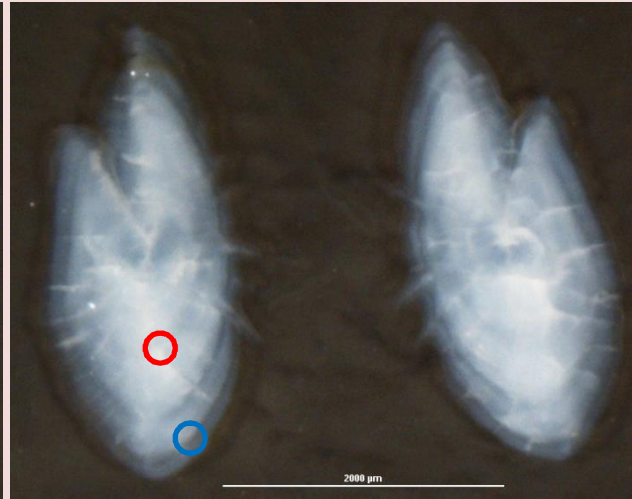
June 22, 2016. Nº 1, **131 mm**  
2 years old. Hyaline edge



June 22, 2016 Nº 34, **131mm**  
2 years old. Hyaline edge



March 16, 2016. N°65, **110 mm**  
 Opaque edge. 1 year old.  
**Central check C 08** (R1 848,00 µm) +  
 1st annual triple rings



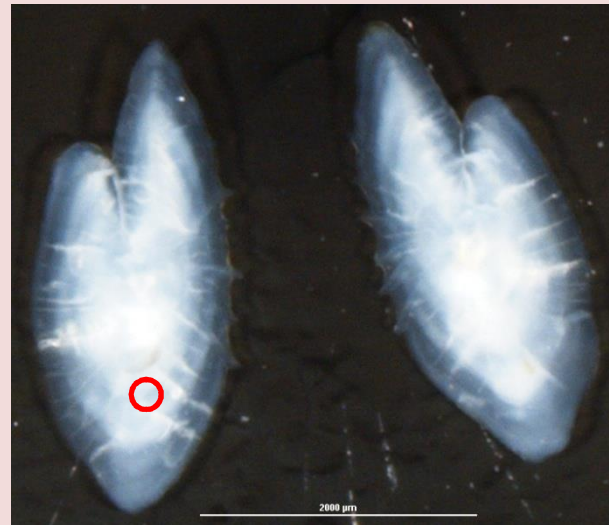
March 16, 2016. N°78, **112 mm**  
 Opaque edge. 1 year old.  
**Central check C 05** ( R1 620,33 µm )+  
 annual winter ring + **spawning check C 18**



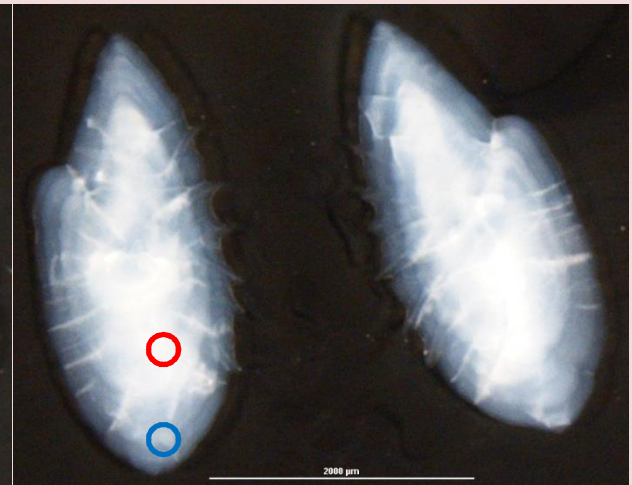
March 16, 2016. N°79, **110 mm**  
 Opaque edge. 1 year old.  
**Central check C 05** (R1 796,90 µm)+  
 1st annual triple rings



March 16,2016. N° 11, **113 mm**. Opaque edge  
 1 year old. **Central check C 05** (R1 778,85 µm)  
 + annual winter ring+ **spawning check C 15**

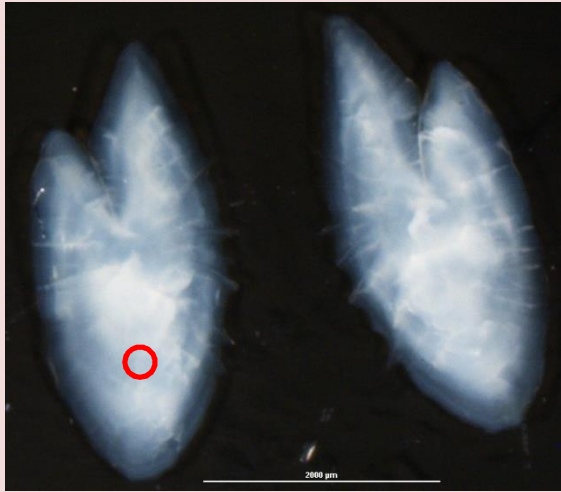


March 16,2016. N°28, **120 mm**  
 Opaque edge. 1 year old  
**Central check C 08** (R1 879,42 µm)  
 + 1st annual double rings

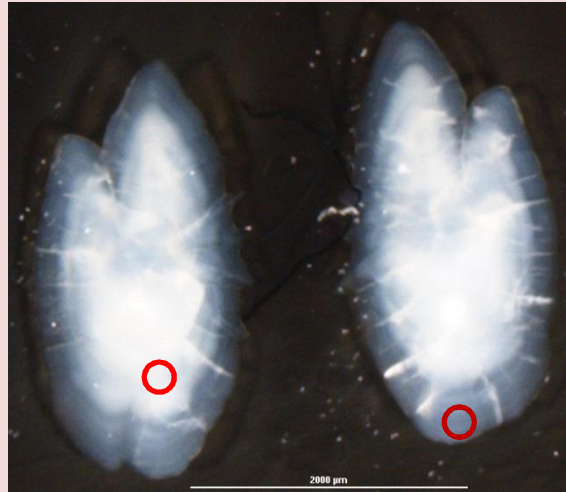


March 16,2016. N° 84, **115 mm**  
 Opaque edge. 1 year old  
**Central check C 05** (R1 795,44 µm)  
 + 1st annual double rings+  
**spawning check C 18**

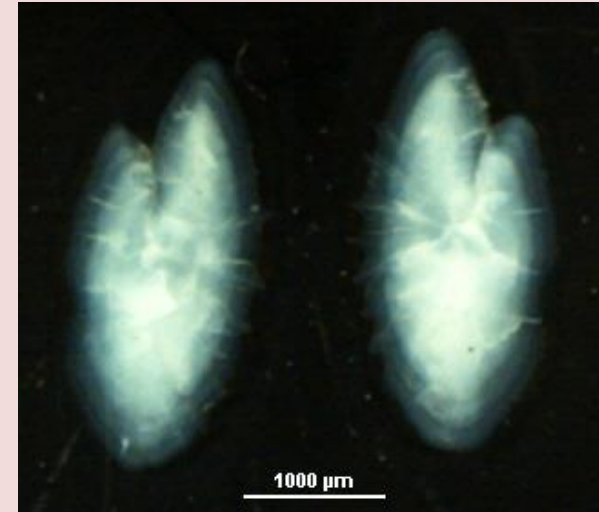




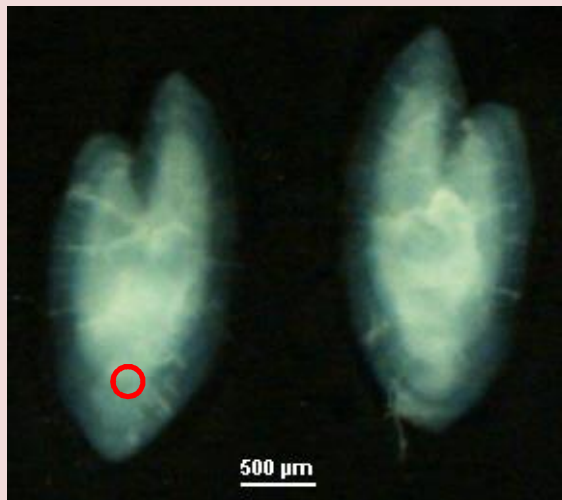
March 16, 2016. N° 29, **137 mm**  
 Opaque edge. 1 year old.  
**Central check C 08** (R1 896,57 μm) +  
 Annual winter ring



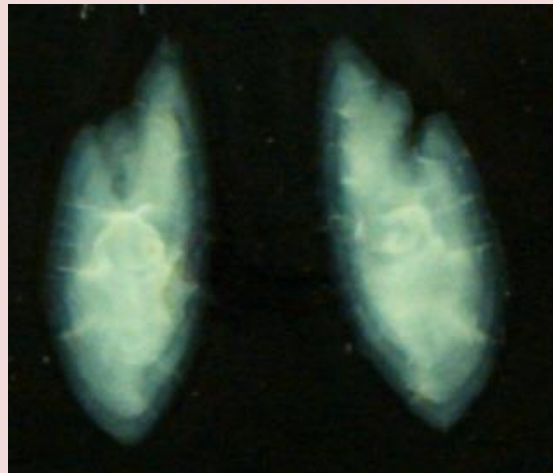
March 16, 2016. N° 91, **117 mm**  
 Opaque edge? 1 year old.  
**Central check C 08** (R1 782,91 μm) +  
 Annual winter ring +  
**spawning check C 15**



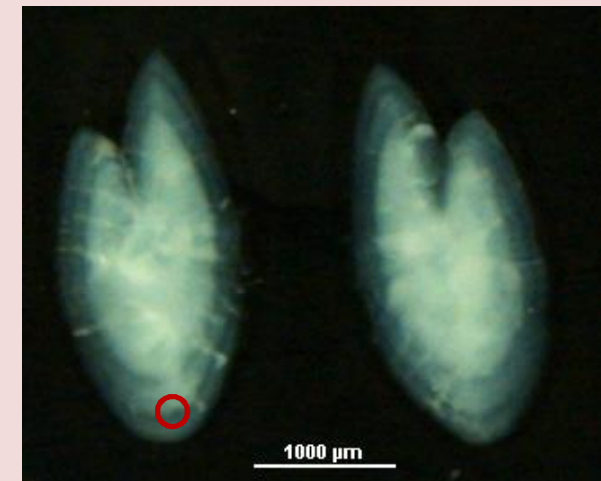
April 21, 2016. N° 60, **128 mm**  
 Opaque edge. 1 year old  
 1st annual double ring  
 or annual ring + spawning check C 15



April 21, 2016. N° 64, **129 mm**  
 Opaque edge. 1 year old  
**Central check C 08** (R1 797,23 μm) +  
 Annual winter ring

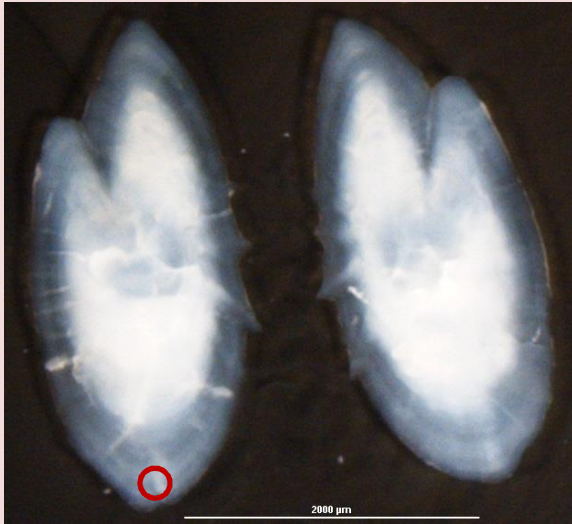


April 21, 2016. N° 82, **140 mm**  
 Opaque edge. 1 year old  
 Spawning check C 15 more marked than  
 Annual ring?

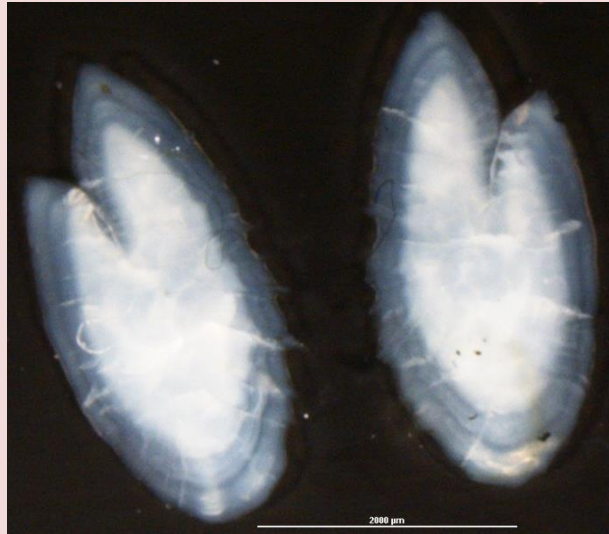


April 21, 2016. N° 83, **144 mm**  
 Opaque edge. 1 year old  
 1st annual winter ring +  
**spawning check C 15**

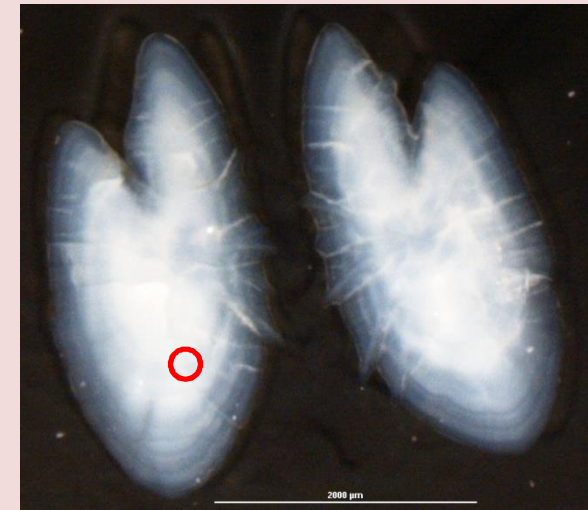




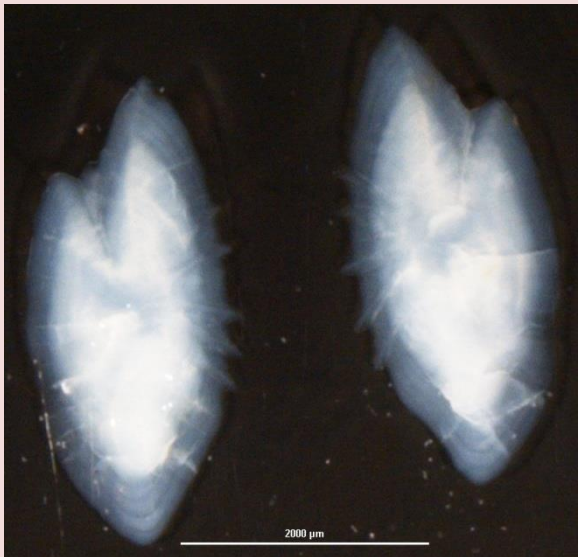
May 5, 2016. N° 2, **128 mm**  
 Hyaline edge. 2 years old  
 1st multi ring and  
 Weak **spawning check C 15**



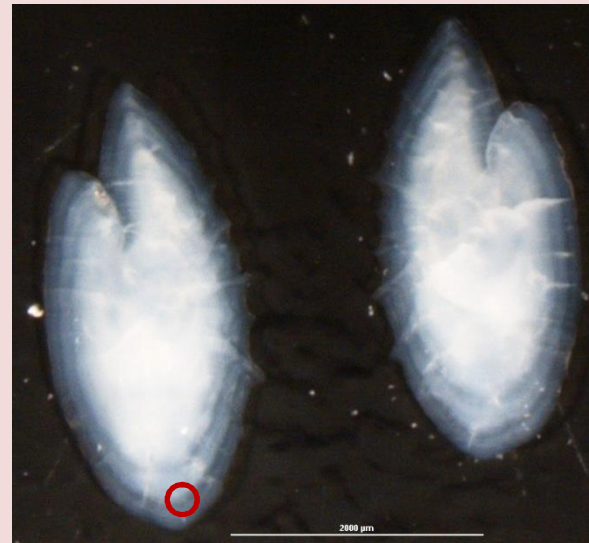
May 5, 2016. N° 3, **140 mm**  
 Hyaline edge. 2 years old  
 Annual double ring or annual winter  
 ring + *spawning check C 12?*



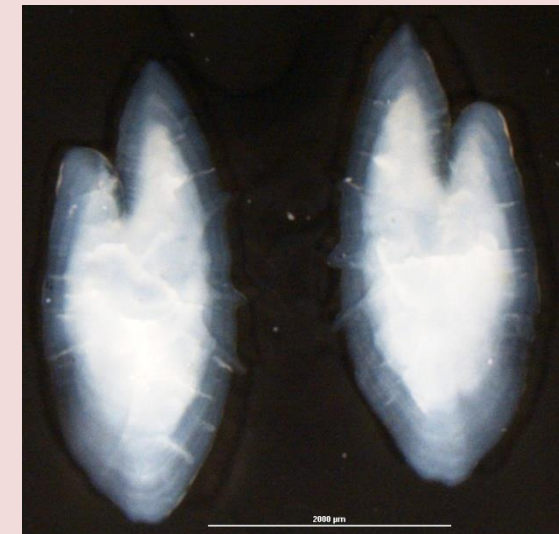
May 5, 2016. N° 4, **138 mm**  
 Hyaline edge. 2 years old  
**Central check C 08** (R1 747,89 µm)+  
*Double spawning check C15 or C12+C15?*



May 5, 2016. N° 6, **140 mm**. Hyaline edge  
 2 years old. 1st annual double ring+  
 Spawning check C 15

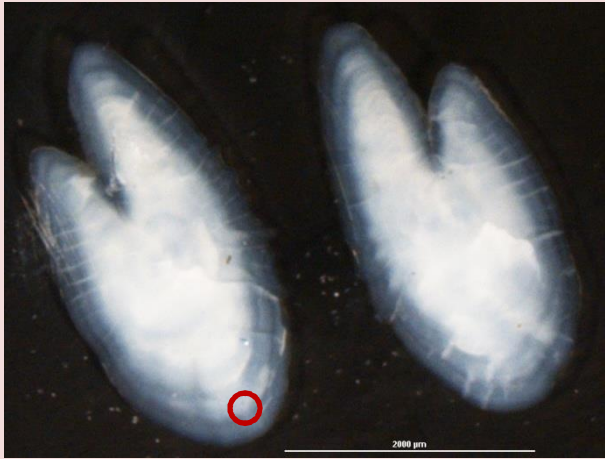


May 5, 2016. N° 8, **125 mm**  
 Hyaline edge. 2 years old.  
**Spawning check C 15**

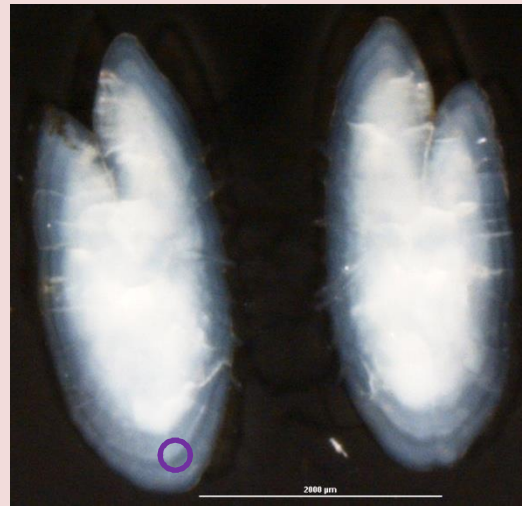


May 5, 2016. N° 22, **145 mm**. Hyaline edge  
 2 years old. Annual winter ring + *double  
 spawning check C 15 or C12 + C15?*

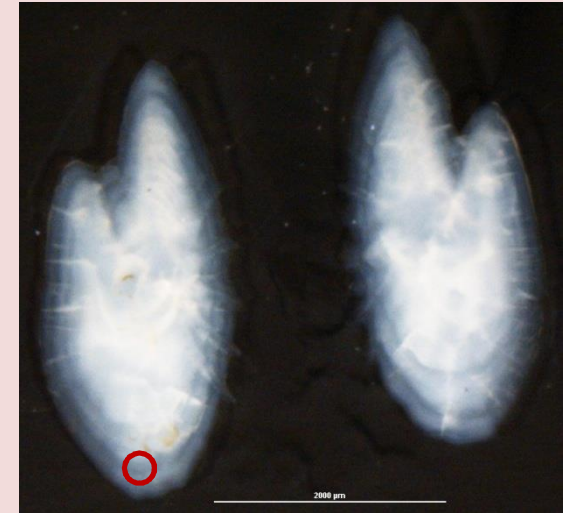




May 10, 2016. N° 41, **137 mm**  
Hyaline edge. 2 years old  
**Spawning check C 15**



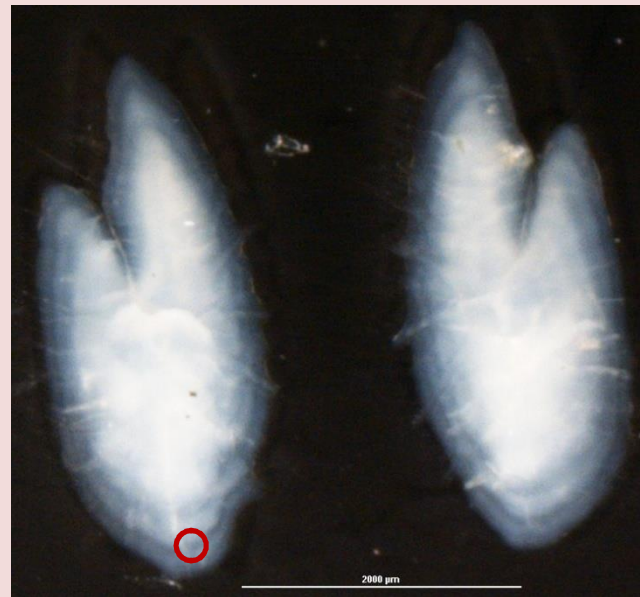
May 10, 2016. N°42, **150 mm**  
Hyaline edge. 2 years old  
**Spawning check C 12**



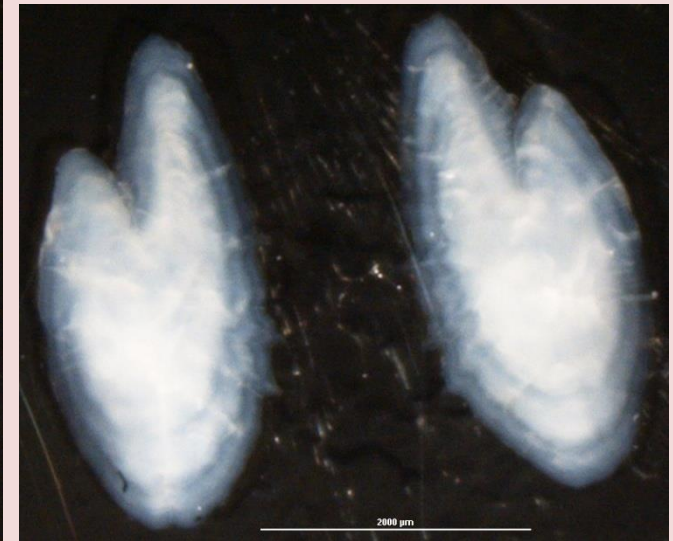
May 10, 2016. N°44, **140 mm**  
Hyaline edge. 2 years old  
**Spawning check C 15**



May 10, 2016. N°47, **141 mm**  
Hyaline edge. 2 years old  
**Spawning check C 15**



May 10, 2016. N° 50, **139mm**  
Hyaline edge. 2 years old  
**Spawning check C 15**



May 10, 2016. N°68, **144 mm**  
Opaque edge? 2 or 3 years old?  
Spawning check C 15 or 2nd annual ring?

# Thank you

