

Problems identification in ageing of otoliths
of Anchovy (*Engraulis encrasicolus*)
from 2014 Exchange
ToR C

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Analysis

1 - Check the age range for each otolith by area

2 – Calculate the age difference

3– Count the number of otoliths for each age difference

4– Identify the possible causes of age differences by area: Discrepances in the position of the annual rings (with or without implications in modal age) by area:

- one figure as an example for a 100% or >80% agreement,
- other figure is an example for a medium high agreement (60-74%)
- third figure are examples for low agreements (<50%);
- the other figures were chosen to show otoliths with a modal age given by the area readers group, not being endorsed by the most experienced readers of other areas

English Channel

% Agreement range	No Otoliths	%
39-60%	6	30%
61-80%	8	40%
81-95%	6	30%
100%	0	0%
Total	20	

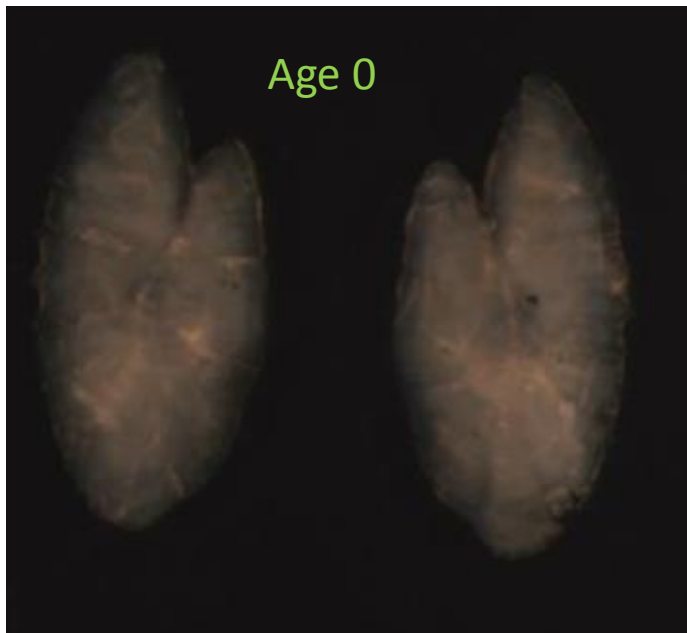
70% of Agreement < 80%

30% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	3	15%
2 age	9	45%
3 age	6	30%
4 age	2	10%

English Channel

Age Reading for anchovy JC_14_TRIM3_CAMANOC_O_0051.jpg,
9.5 cm, male, caught October 2014
Conventional birthdates: 1st January



89% agreement Age 0

“ Readings: 0-1 years

“ 3 Readers not agree with modal age
(only training readers)

Problems identification:

“ Annual Growth pattern

English Channel

Age Reading for anchovy JC_14_TRIM3_CAMANOC_O_0005.jpg,
16.5 cm, male, caught September 2014
Conventional birthdates: 1st January



44 % agreement Age 1

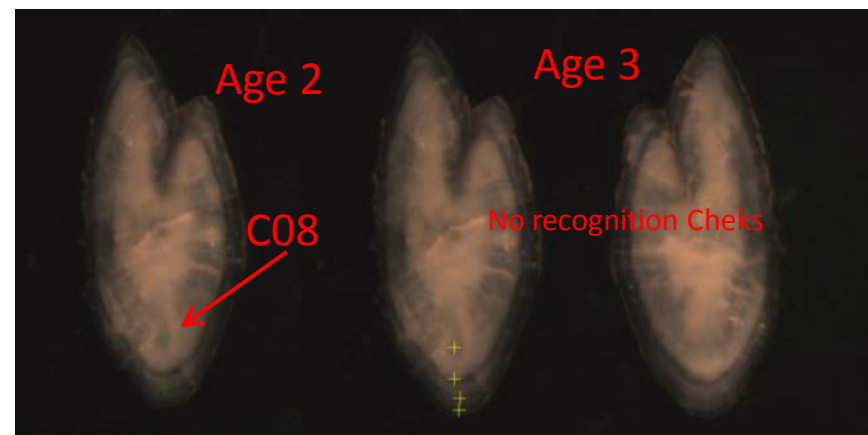
" Readings: 1-3 years

" 10 Readers not agree with modal age (2 Expert reader)

Problems identification:

" Annual Growth pattern

" True Annual ring/checks



English Channel

Age Reading for anchovy JC_14_TRIM3_CAMANOC_O_0029.jpg,
18 cm, female, caught in September 2014
Conventional birthdates: 1st January



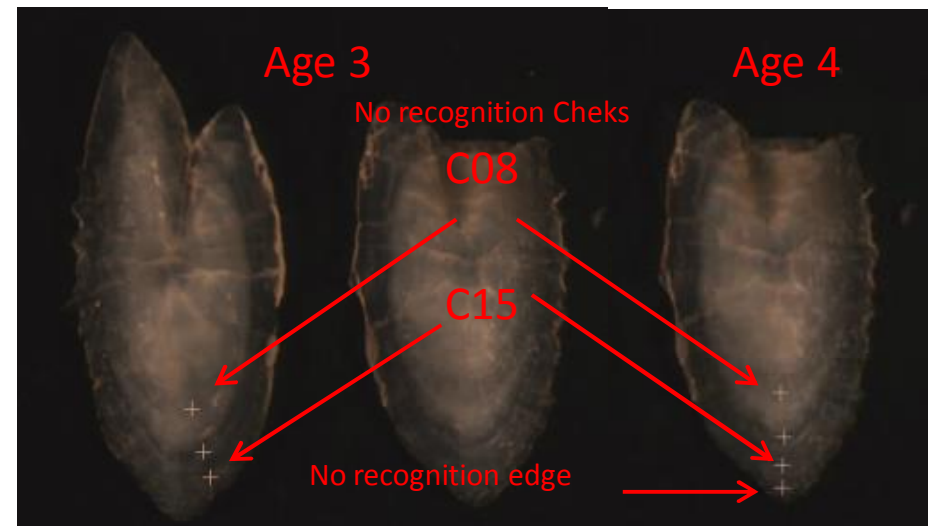
Problems identification:
" Annual Growth pattern
" True Annual ring/checks
" Edge or confusion with the conventional birthdates

39 % agreement Age 2

" Readings: 1-4 years

" 11 Readers not agree with modal age (7 Expert reader)

" Modal age 1 for Expert Readers



Bay of Biscay

% Agreement range	No Otoliths	%
44-60%	12	17%
61-80%	30	43%
81-95%	26	37%
100%	2	3%
Total	70	

60% of Agreement < 80%

40% of Agreement >80%

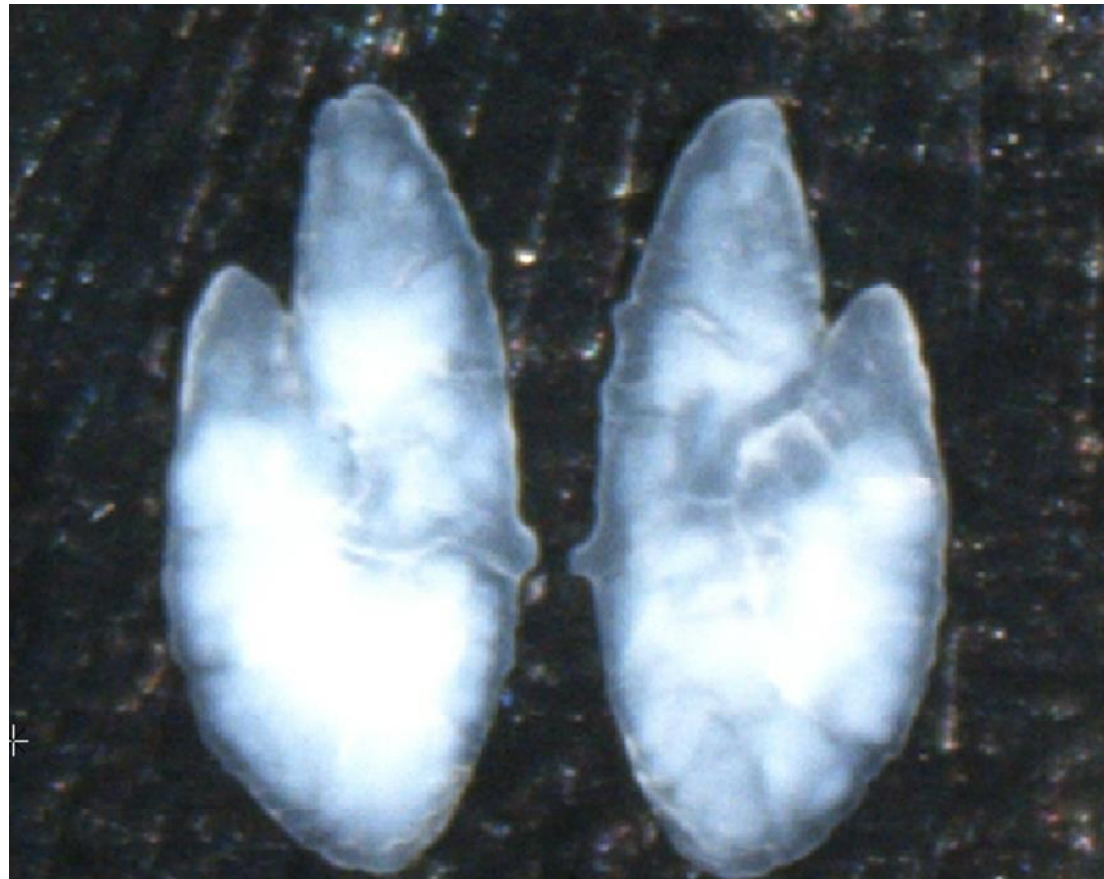
Difference of age	Nº Otoliths	%
0 age	2	3%
1 age	26	37%
2 age	36	51%
3 age	6	9%

Bay of Biscay

Age Reading for anchovy ANE01112011_114_8_11.jpg:
9.6 cm, indeterminate, caught November 2011
Conventional birthdates: 1st January

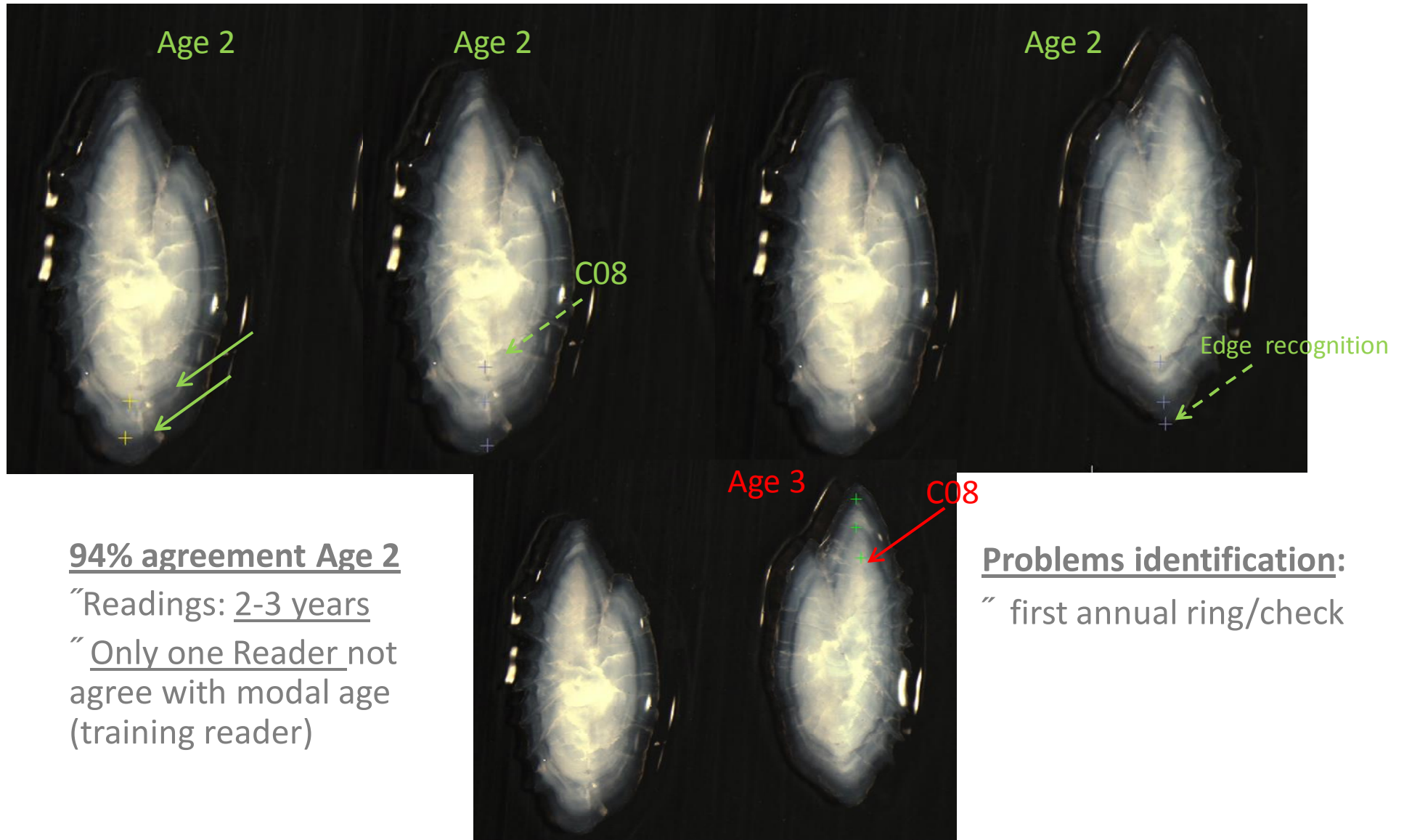
100% agreement Age 0

2 otoliths, from 70
otoliths in the Exchange
(3%)



Bay of Biscay

Age Reading for anchovy ANE-260913-1_40.jpg,
15.8 cm, male, caught September 2013,
Conventional birthdates: 1st January



94% agreement Age 2

“Readings: 2-3 years”

“Only one Reader not agree with modal age (training reader)”

Problems identification:

“ first annual ring/check”

Bay of Biscay

Age Reading for anchovy ANE-230413-1_39.jpg,
16.4 cm, female, caught April 2013,
Conventional birthdates: 1st January



72% agreement Age 3

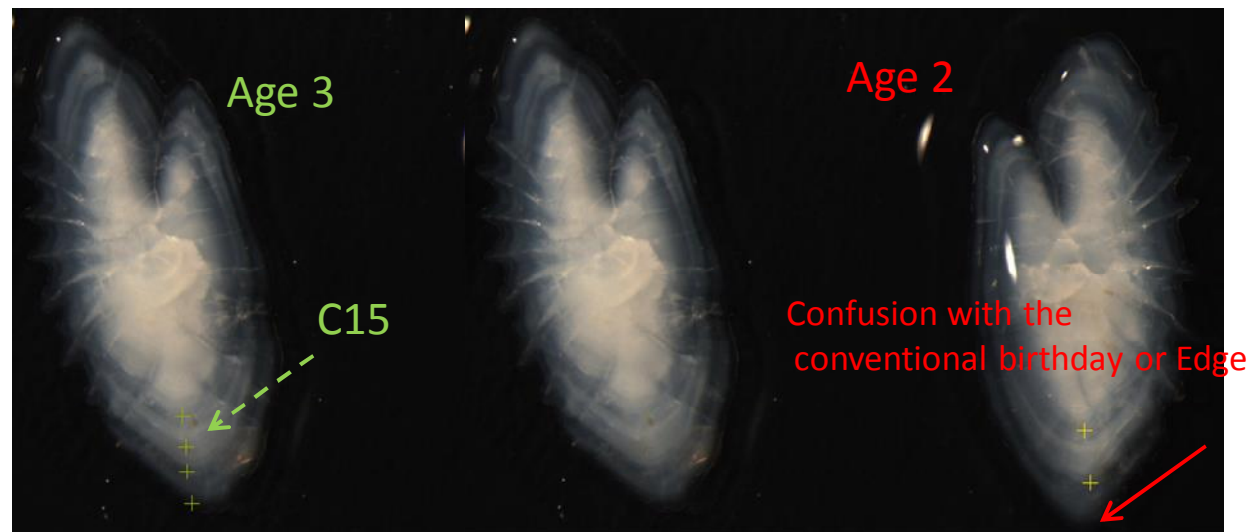
“Readings: 2-3 years”

“5 Readers not agree with modal age (1 Expert reader)”

Problems identification:

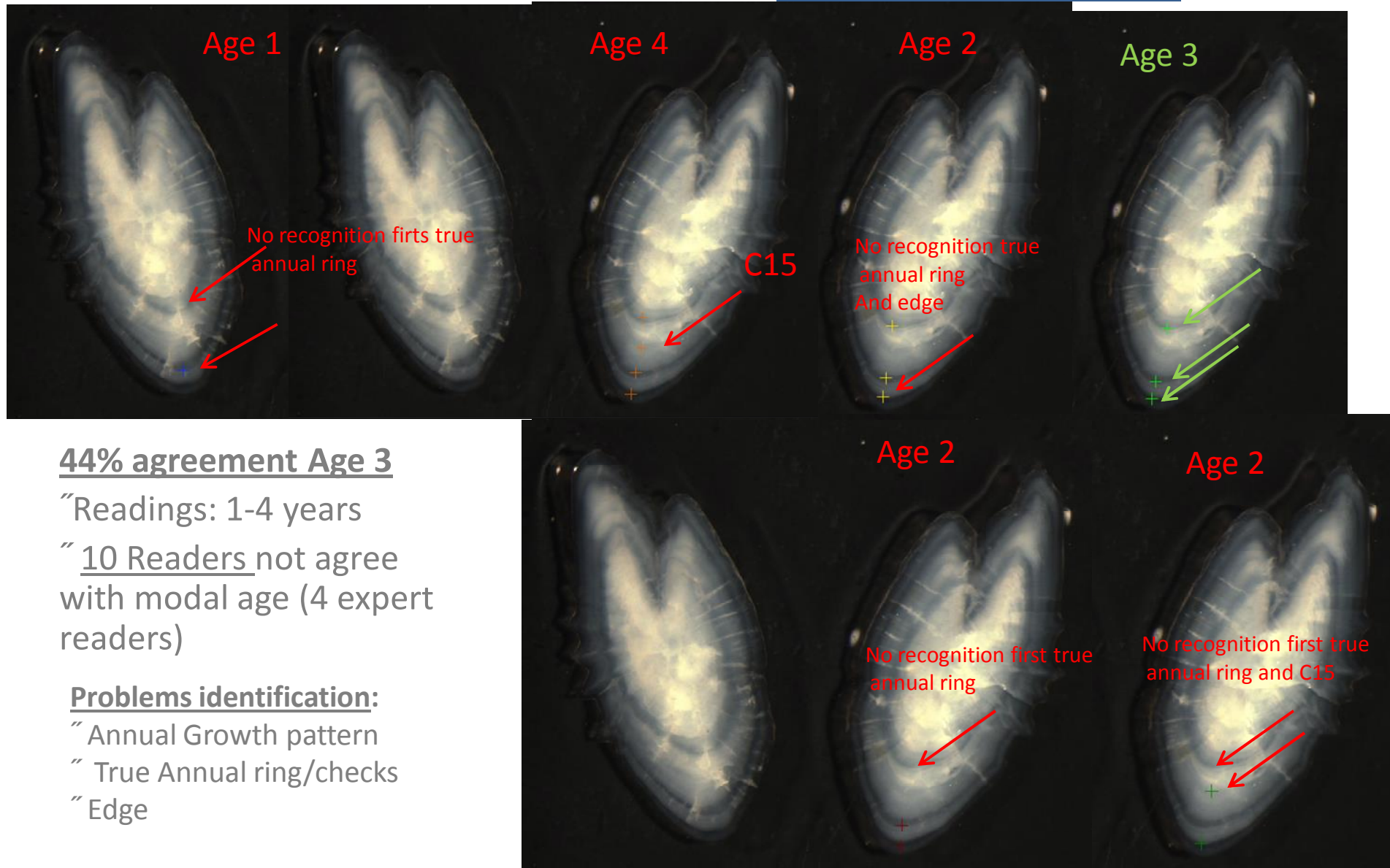
“Annual Growth pattern”

“Edge or confusion with the conventional birthdates”



Bay of Biscay

Age Reading for anchovy ANE-260913-1_38.jpg:
15.8 cm, undefinid, caught September 2013,
Conventional birthdates: 1st January



44% agreement Age 3

“Readings: 1-4 years

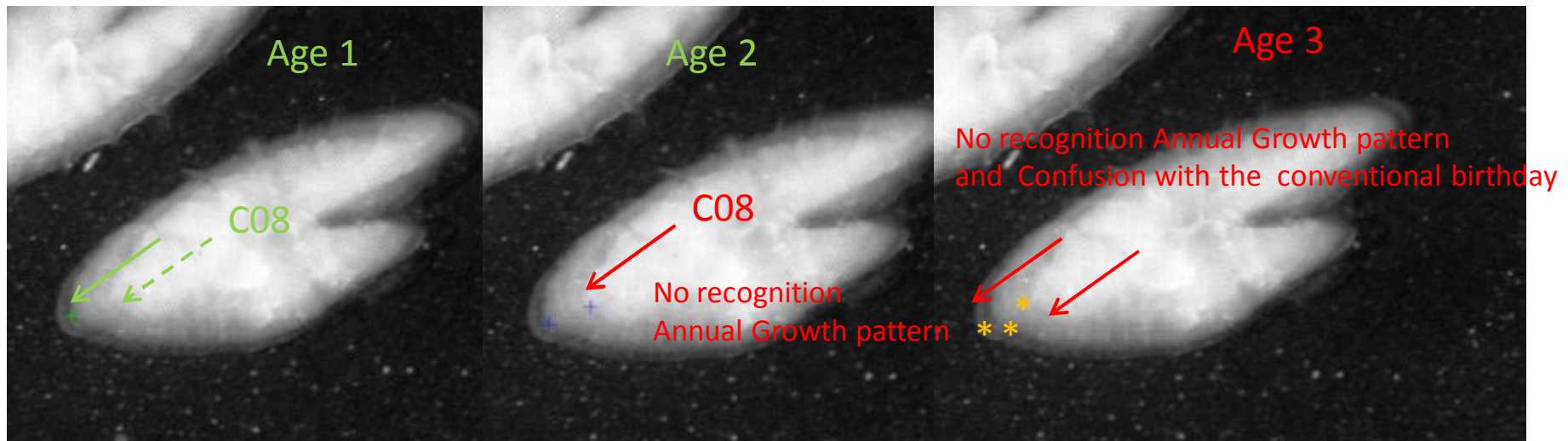
“ 10 Readers not agree with modal age (4 expert readers)

Problems identification:

- “ Annual Growth pattern
- “ True Annual ring/checks
- “ Edge

Bay of Biscay

Age Reading for anchovy r5020b8.jpg,
15.0 cm, female, caught March 2013,
Conventional birthdates: 1st January



67 % agreement Age 2

~ Readings: 1-3 years

~ 6 Readers not agree with modal age (4 expert readers)

~ Modal Age 1 for Area Readers

~ Modal age 2 for Expert Readers

Problems identification:

~ Annual Growth pattern

~ First Annual ring/checks

~ Edge (conventional birthdates)

Division IXa

% Agreement range	No Otoliths	%
44-60%	25	27%
61-80%	48	52%
81-95%	18	20%
100%	1	1%
Total	92	

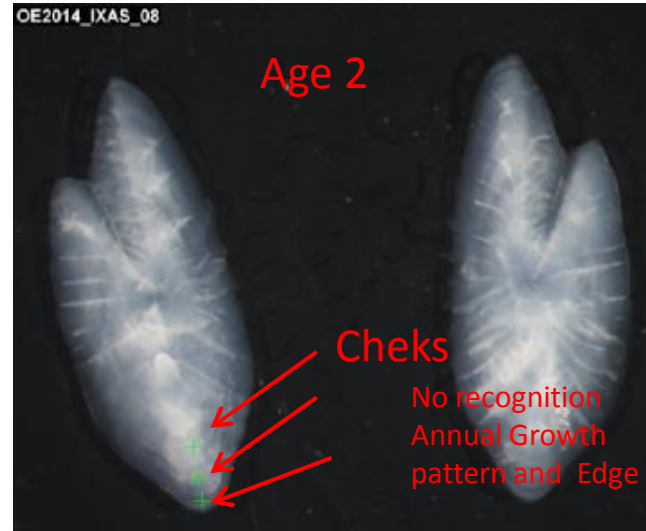
79% of Agreement < 80%

21% of Agreement >80%

Difference age range	Nº Otolliths	%
0 age	1	1%
1 age	34	37%
2 age	43	47%
3 age	14	15%

Division IXa

Age Reading for anchovy OE2014_IXAS_08.jpg:
11.7 cm, female, caught March 2013,
Conventional birthdates: 1st January



94 % agreement Age 1

“Readings: 1-2 years

“ 1 Reader not agree with modal age

Problems identification:

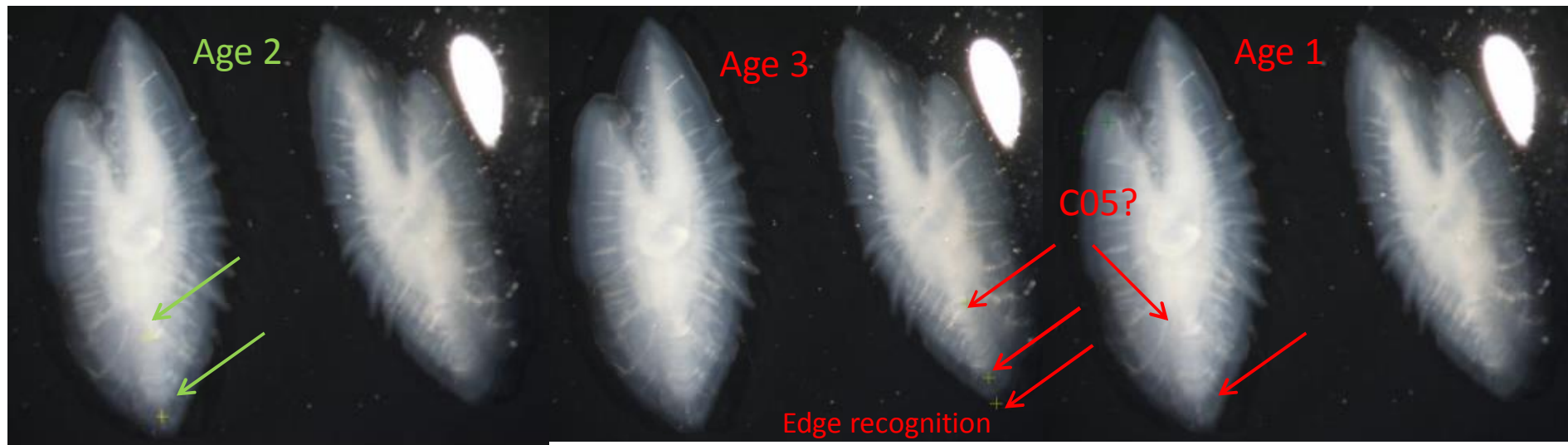
“ Annual Growth pattern

“ First Annual ring/checks

“ Edge (conventional birthdates)

Division IXa

Age Reading for anchovy OE2014_IXAS_48.jpg:
14.5 cm, female, caught August 2013,
Conventional birthdates: 1st January



72 % agreement Age 2

“Readings: 1-4years

“ 5 Readers not agree
with modal age (3
Expert readers)

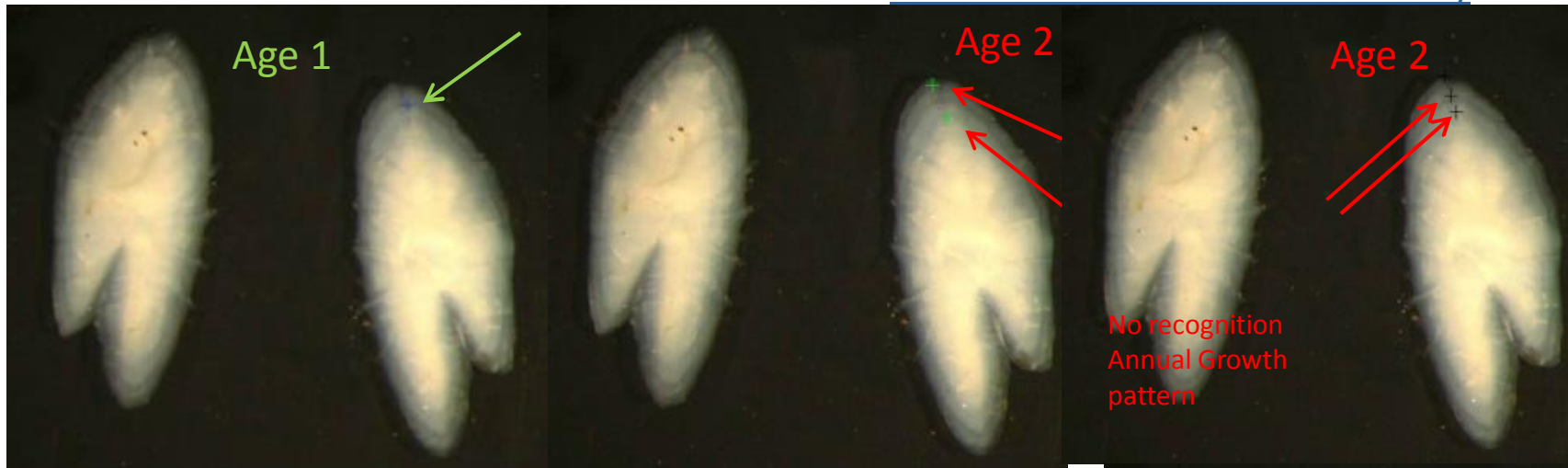
Problems identification:

- “ Annual Growth pattern
- “ First Annual ring/checks
- “ Edge



Division IXa

Age Reading for anchovy IPMA_ANEIXaCN_8B.jpg,
16.5 cm, female, caught September 2011,
Conventional birthdates: 1st January



44 % agreement Age 1

“Readings: 1-3 years

“ 10 Readers not agree
with modal age (3
Expert reader)

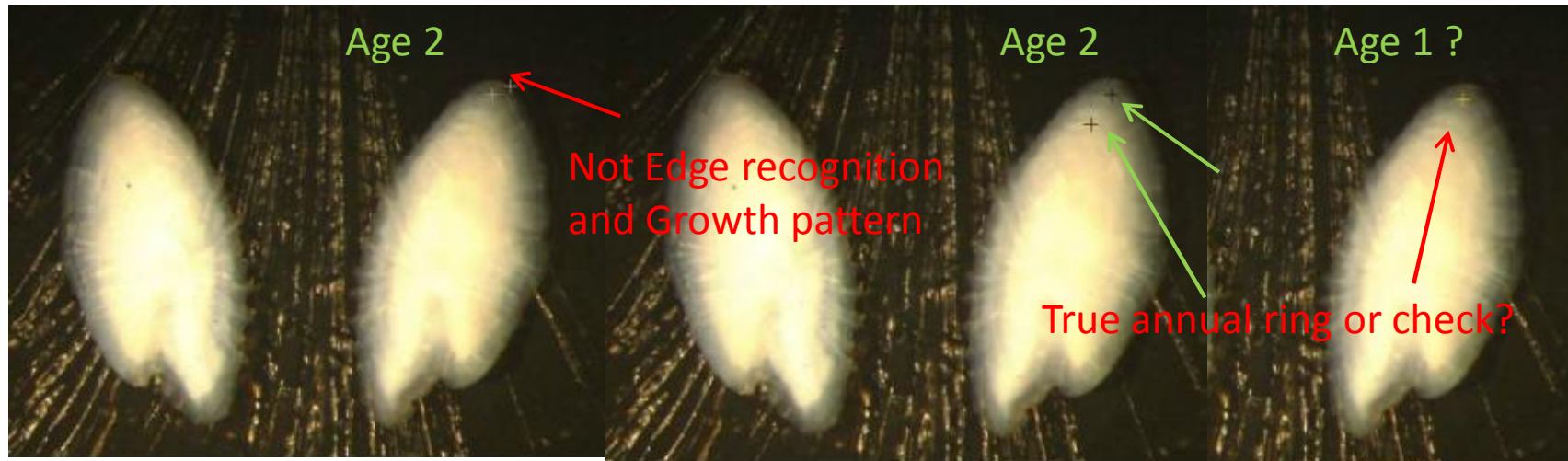
Problems identification:

- “ Annual Growth pattern
- “ First Annual ring/checks
- “ Edge recognition



Division IXa

Age Reading for anchovy IPMA_ANEIXaCN_7A.jpg:
14.5 cm, female, caught May 2013,
Conventional birthdates: 1st January



56 % agreement Age 2

“Readings: 1-3 years

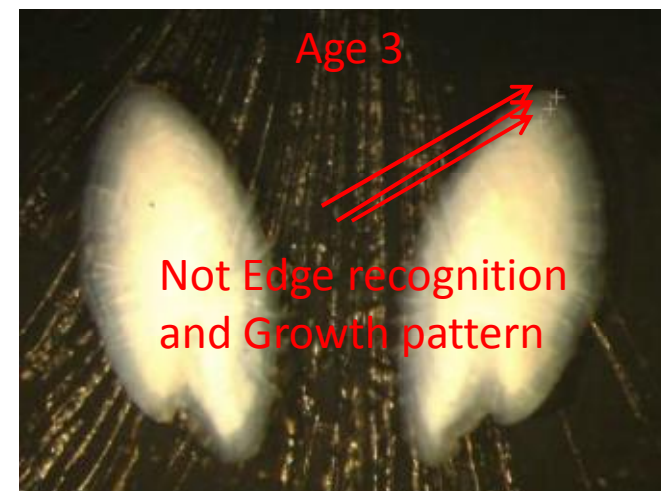
“ 8 Readers not agree with modal age (5 Expert reader)

“ Modal Age 2 for Area Readers

“ Modal age 1 for Expert Readers

Problems identification:

- “ Annual Growth pattern
- “ First Annual ring/checks
- “ Edge recognition



Alboran Sea- GSA01

% Agreement range	No Otoliths	%
33-60%	42	60%
61-80%	19	27%
81-95%	9	13%
100%	0	0%
Total	70	

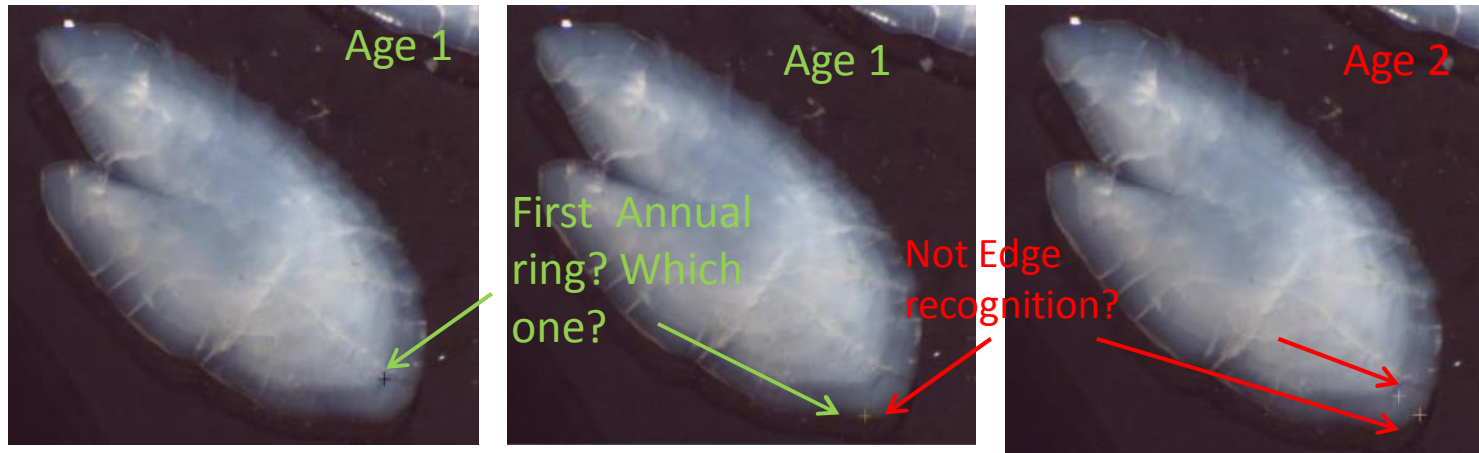
87% of Agreement < 80%

13% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	8	11%
2 age	28	40%
3 age	30	43%
4 age	4	6%

Age Reading for anchovy 08082013-031.jpg:
11.3 cm, male, caught August 2013,
Conventional birthdates: 1st July

Alboran Sea- GSA01



88 % agreement Age 1

“Readings: 1-2 years

“ 2 Readers not agree
with modal age
(Training readers)

Doubt: It could be age 2 because the birthday
is July 1?

Problems identification:

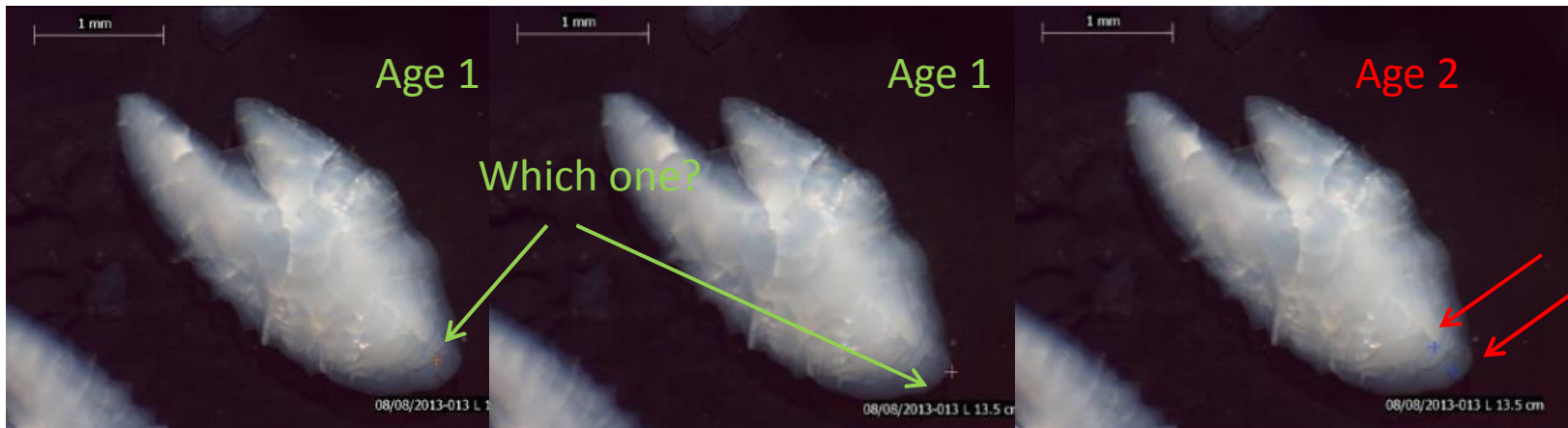
- “ Edge
- “ First Annual ring/checks

Alboran Sea- GSA01

Age Reading for anchovy 08082013-013.jpg:

13.7 cm, female, caught August 2013

Conventional birthdates: 1st July



71 % agreement Age 1

“Readings: 1-3 years

“5 Readers not agree
with modal age (1
Expert reader)

Problems identification:

“Growth pattern

“Edge

“First Annual ring/checks

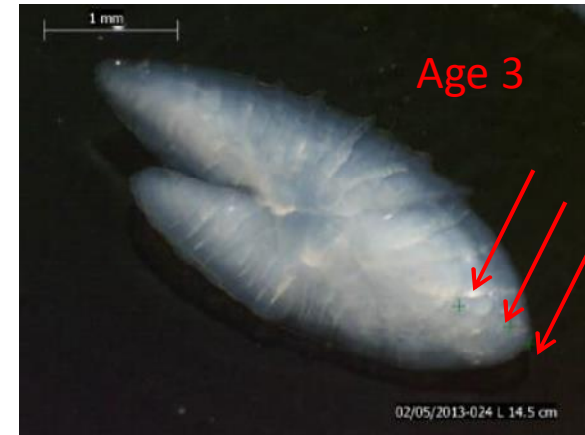
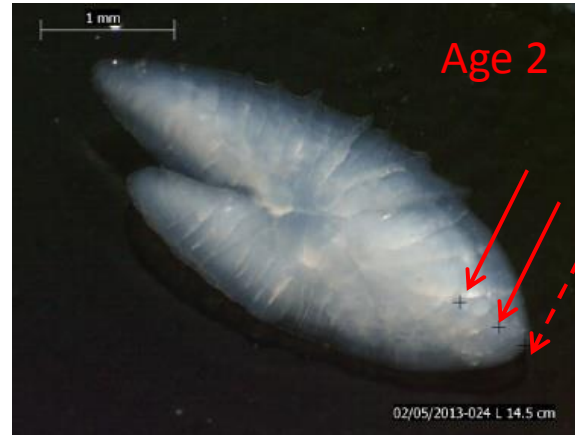
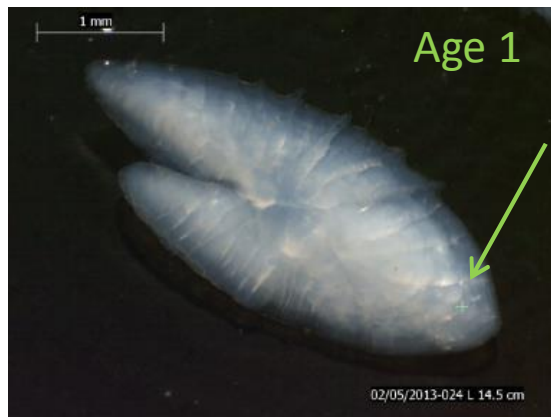


Alboran Sea- GSA01

Age Reading for anchovy 02052013-024.jpg:

14.6 cm, male, caught May 2013

Conventional birthdates: 1st July



Not Edge recognition
and Growth pattern

33 % agreement Age 1

“Readings: 0-3 years

“ 12 Readers not agree
with modal age (5
Expert readers)

Problems identification:

“Growth pattern

“Edge

“ First Annual ring/checks

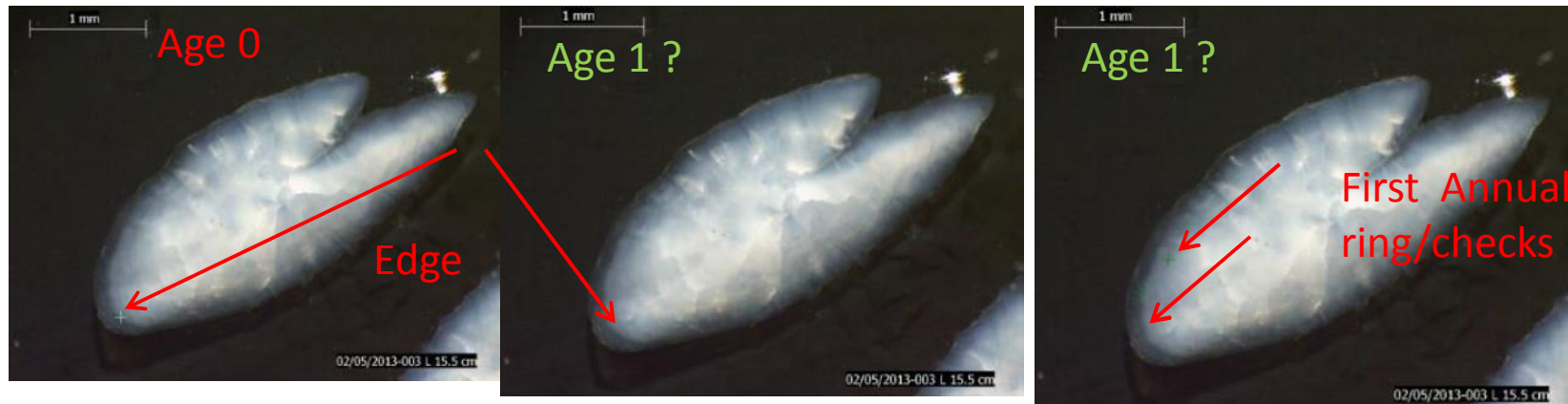


Alboran Sea- GSA01

Age Reading for anchovy 02052013-003.jpg:

15.5 cm, male, caught May 2013

Conventional birthdates: 1st July



39 % agreement Age 2

"Readings: 0-3 years

" 11 Readers not agree with modal age (7 Expert readers)

" Age 1 for Area Reader

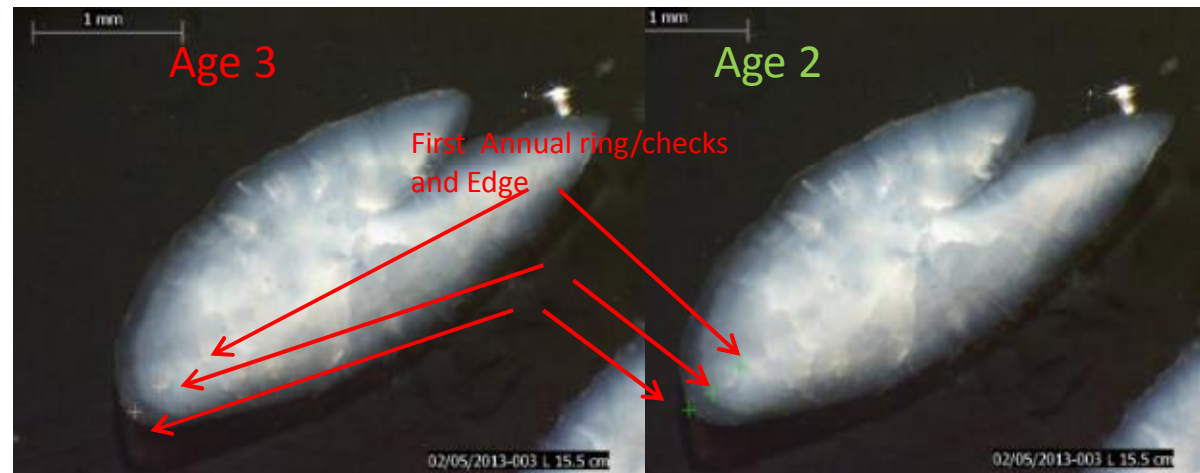
" Age 1 for Expert Readers

Problems identification:

"Growth pattern

"Edge

" First Annual ring/checks



Western Mediterranean- GSA06

% Agreement range	No Otoliths	%
18-60%	28	46%
61-80%	31	51%
81-95%	2	3%
100%	0	0%
Total	61	

97% of Agreement < 80%

3% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	8	13%
2 age	28	46%
3 age	30	49%

Western Mediterranean-
GSA06

Age Reading for anchovy 1308013-033.jpg:

14.5 cm, female, caught August 2013

Conventional birthdates: 1st July



Check?

83 % agreement Age 2

"Readings: 1-3 years

"3 Readers not agree
with modal age (1
Expert reader)

Problems identification:

"Growth pattern

"Edge

"Annual ring/checks



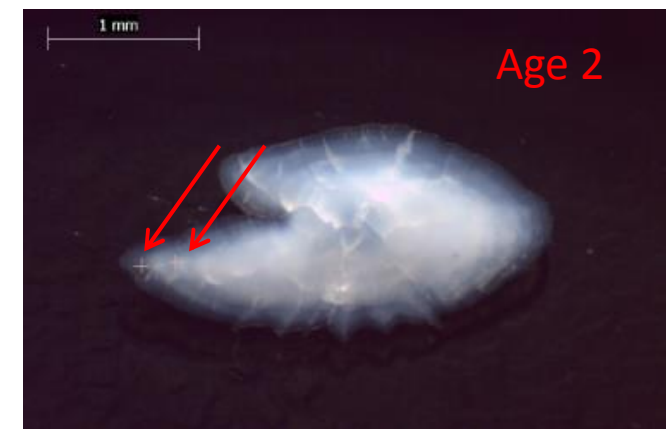
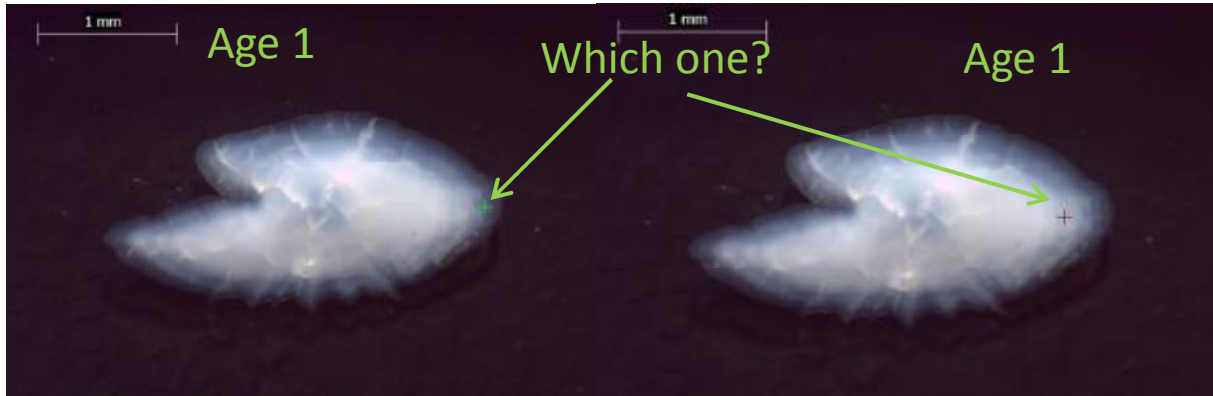
Growth pattern
and checks

Western Mediterranean- GSA06

Age Reading for anchovy 1308013-008.jpg:

11.9 cm, female, caught August 2013

Conventional birthdates: 1st July



72 % agreement Age 1

“Readings: 0-2 years

“5 Readers not agree
with modal age (2
Expert reader)

Problems identification:

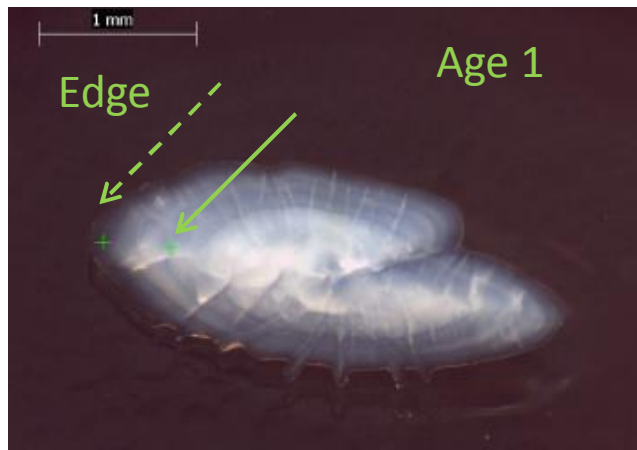
“Growth pattern
“Annual ring/checks

Western Mediterranean- GSA06

Age Reading for anchovy 10042013-019.jpg:

13.2 cm, male, caught April 2013

Conventional birthdates: 1st July



41 % agreement Age 1

"Readings: 0-3 years

"10 Readers not agree with modal age (6 Expert reader)

Problems identification:

"Growth pattern

"Annual ring/checks

"Edge

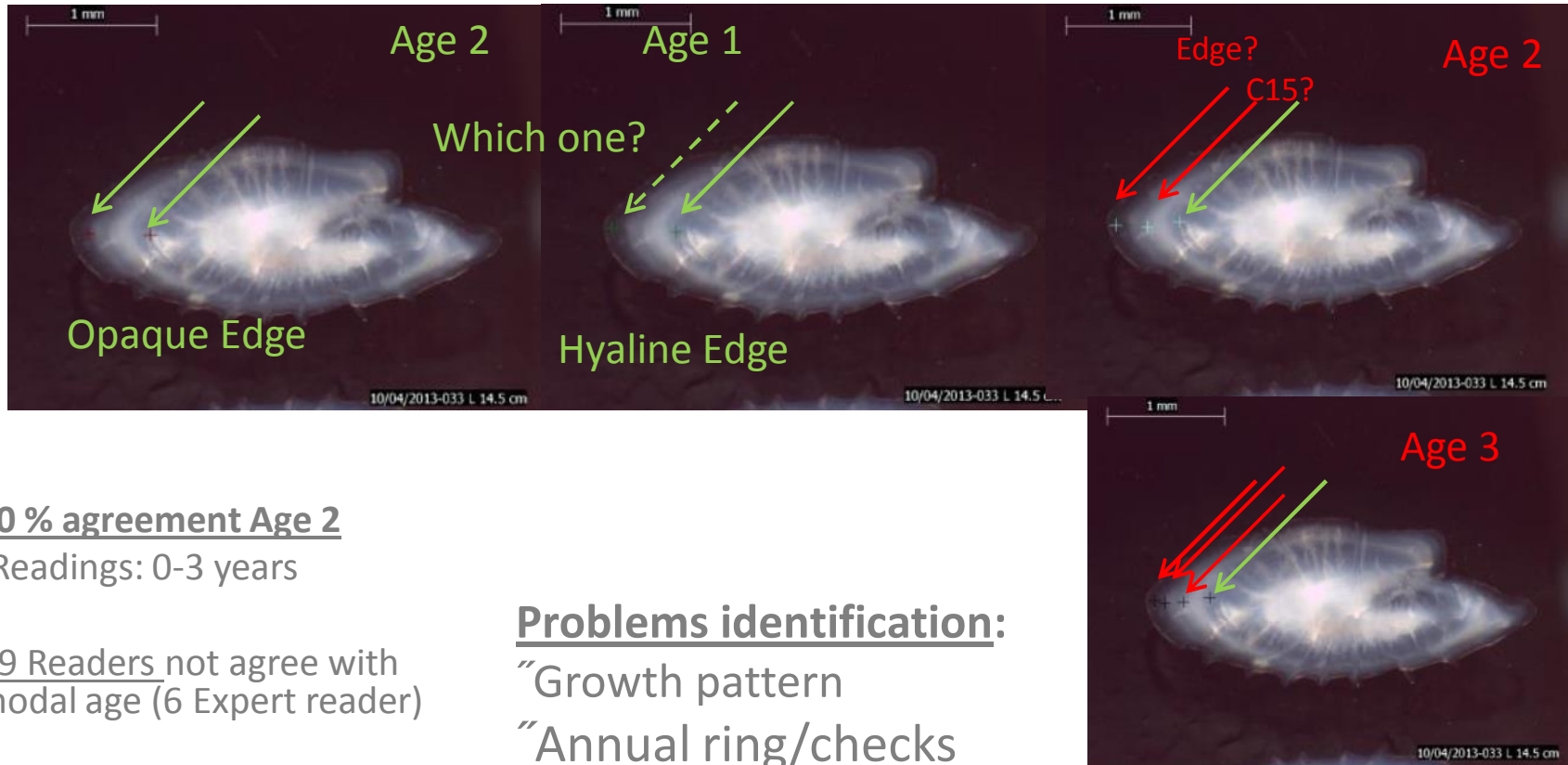


Western Mediterranean- GSA06

Age Reading for anchovy 10042013-033.jpg:

14.6 cm, female, caught April 2013

Conventional birthdates: 1st July



50 % agreement Age 2

“Readings: 0-3 years

“ 9 Readers not agree with modal age (6 Expert reader)

“ Age 1 for Area Reader

“ Age 1 for Expert Readers

Problems identification:

“Growth pattern

“Annual ring/checks

“Edge

Gulf Of Lion-GSA07

% Agreement range	No Otoliths	%
32-60%	9	24%
61-80%	13	34%
81-95%	13	34%
100%	3	8%
Total	38	

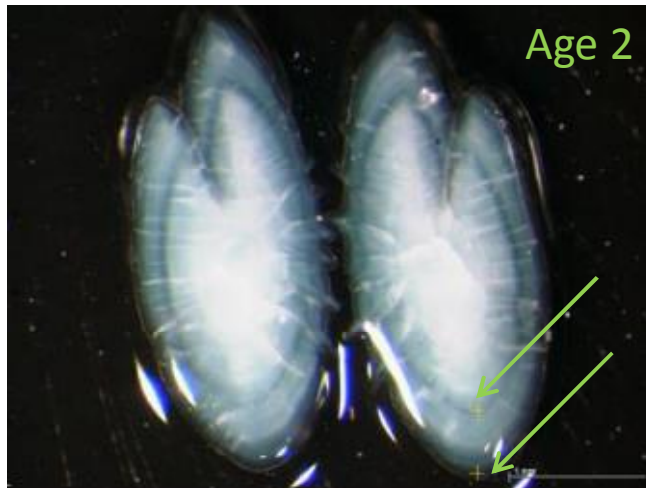
58% of Agreement < 80%

42% of Agreement >80%

Difference age range	Nº Otolliths	%
0 age	3	8%
1 age	17	45%
2 age	18	47%
3 age	0	0%

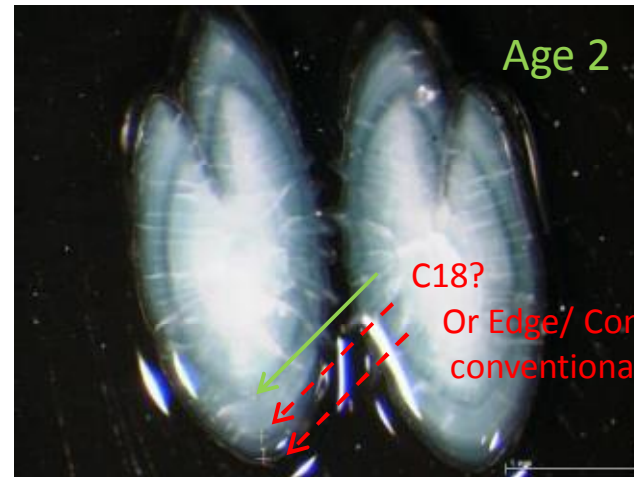
Gulf Of Lion-GSA07

Age Reading for anchovy EB_14_b20_O_0042.jpg:
14.0 cm, female, caught February 2014,
Conventional birthdates: 1st January



100 % agreement Age 2

“Readings: 2 years



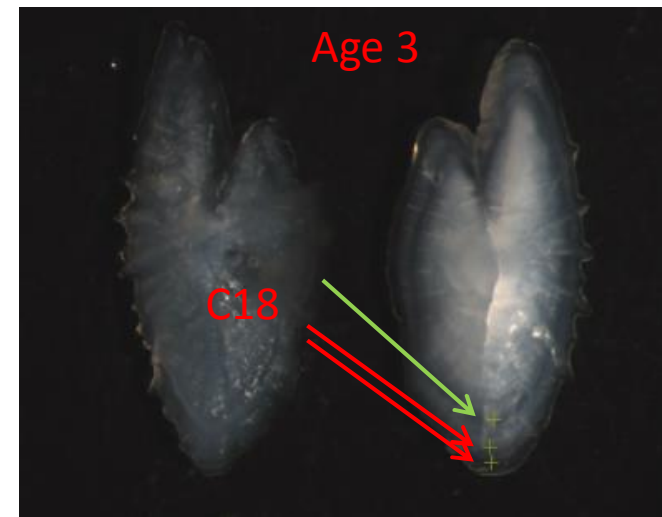
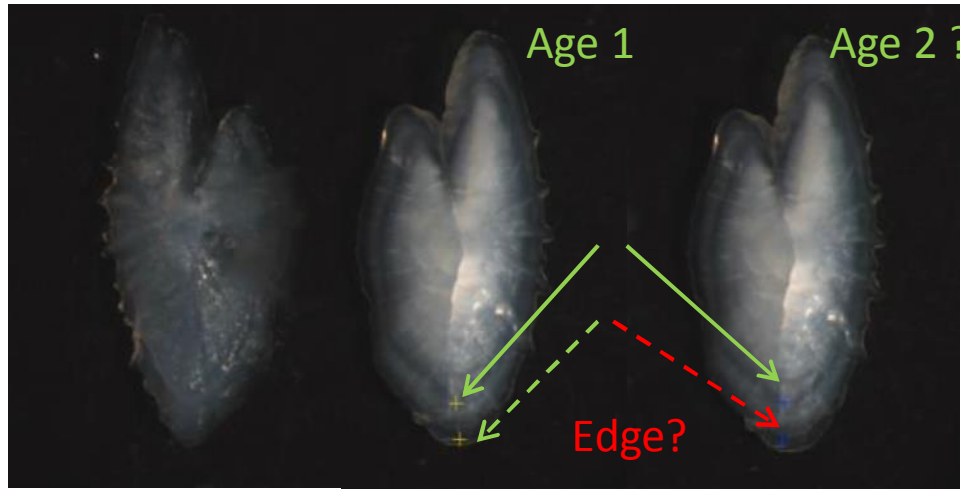
Problems identification:

“Checks

“Edge or confusion with conventional birthday

Gulf Of Lion-GSA07

Age Reading for anchovy EB_14_b18_O_0176.jpg:
14.3 cm, female, caught July 2014,
Conventional birthdates: 1st January



61% agreement Age 1

“Readings: 1-3 years

“ 7 Readers not agree with modal age (4 Expert readers)

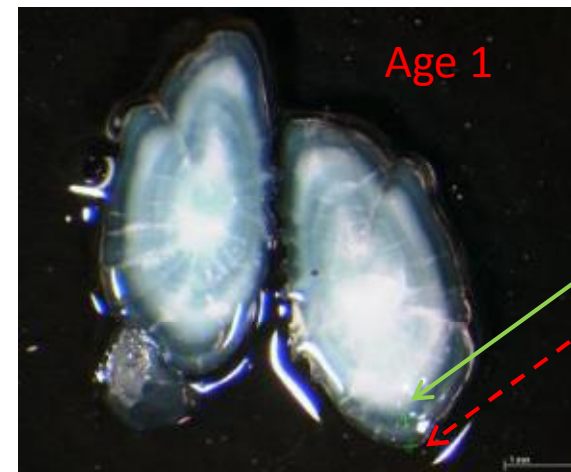
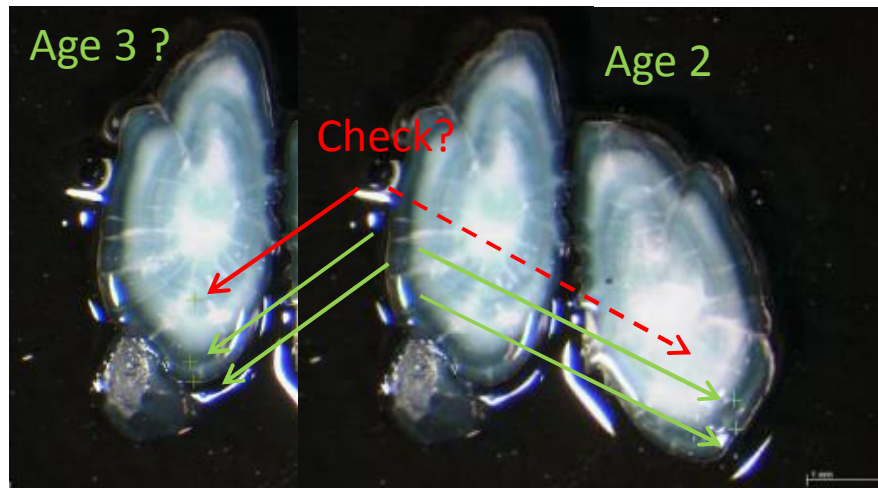
Problems identification:

“Checks

“Edge

Gulf Of Lion-GSA07

Age Reading for anchovy EB_14_b20_O_0074.jpg:
12.0 cm, female, caught February 2014,
Conventional birthdates: 1st January



44% agreement Age 2

"Readings: 1-3 years

" 4 Readers not agree with modal age (4 Expert readers)

Problems identification:

"Checks

"Edge

"Growth pattern

Gulf Of Lion-GSA07

Age Reading for anchovy EB_14_b20_O_0037.jpg:
11.0 cm, male, caught February 2014,
Conventional birthdates: 1st January



67% agreement Age 1

“Readings: 1-2 years

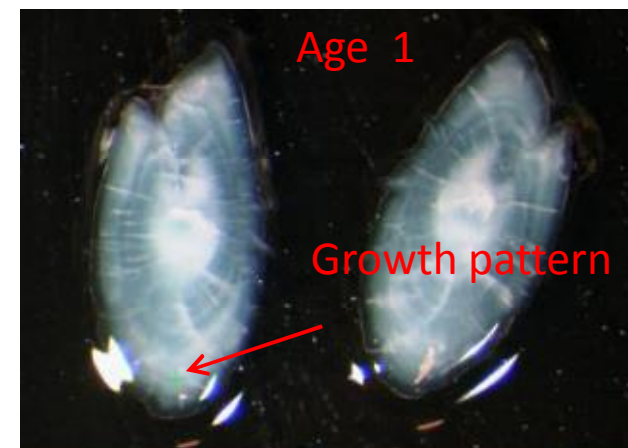
“6 Readers not agree with modal age (4 Expert readers)

“Modal Age 2 for Expert Readers

Problems identification:

“Checks

“Growth pattern



Southern Tyrrhenian- GSA10

% Agreement range	No Otoliths	%
39-60%	17	31%
61-80%	36	65%
81-95%	2	4%
100%	0	0%
Total	55	

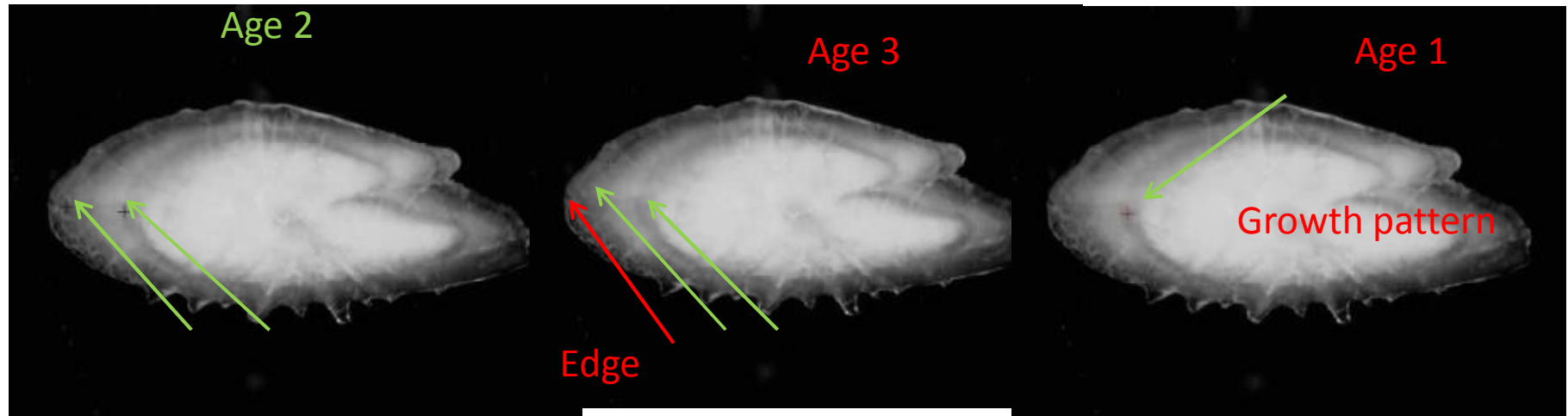
96% of Agreement < 80%

4% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	24	44%
2 age	30	55%
3 age	1	2%

Southern Tyrrhenian- GSA10

Age Reading for GSA10_09.jpg:
13.5 cm, male, caught August 2013,
Conventional birthdates: 1st July



89% agreement Age 2

“Readings: 1-3 years

“2 Readers not agree with modal age

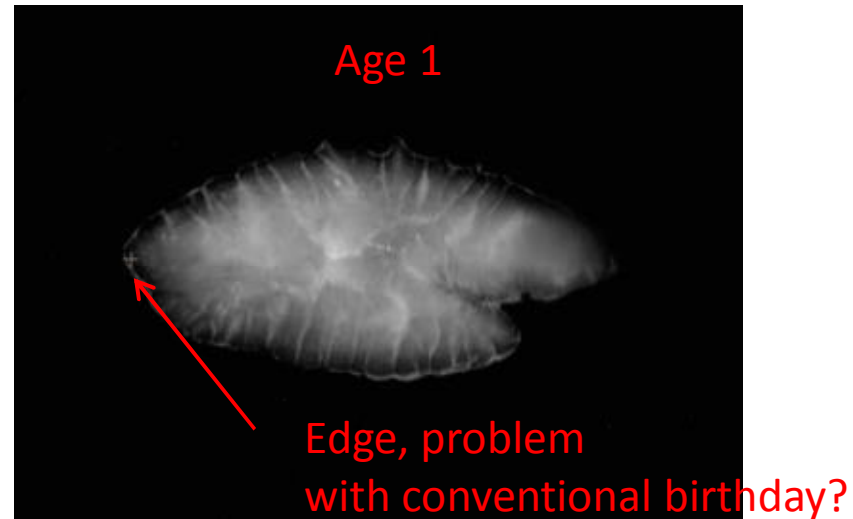
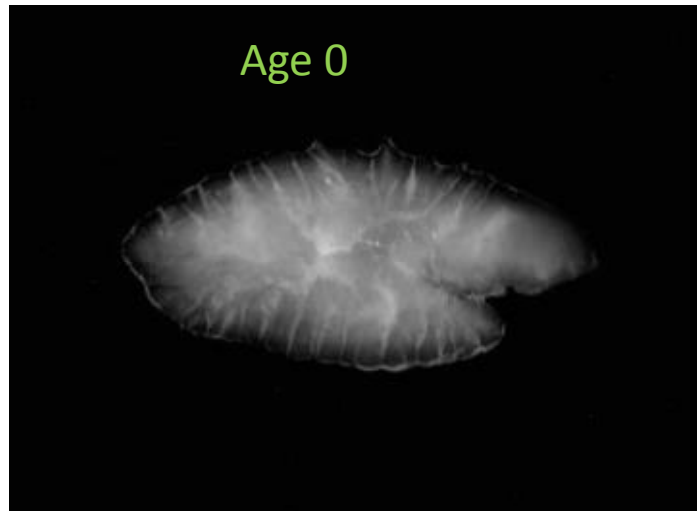
Problems identification:

“Edge

“Growth pattern

Southern Tyrrhenian- GSA10

Age Reading for GSA10_23.jpg:
8.0 cm, undefined, caught August 2012,
Conventional birthdates: 1st July



67% agreement Age 0

"Readings: 0-1 years

"6 Readers not agree with modal age (4 Expert readers)

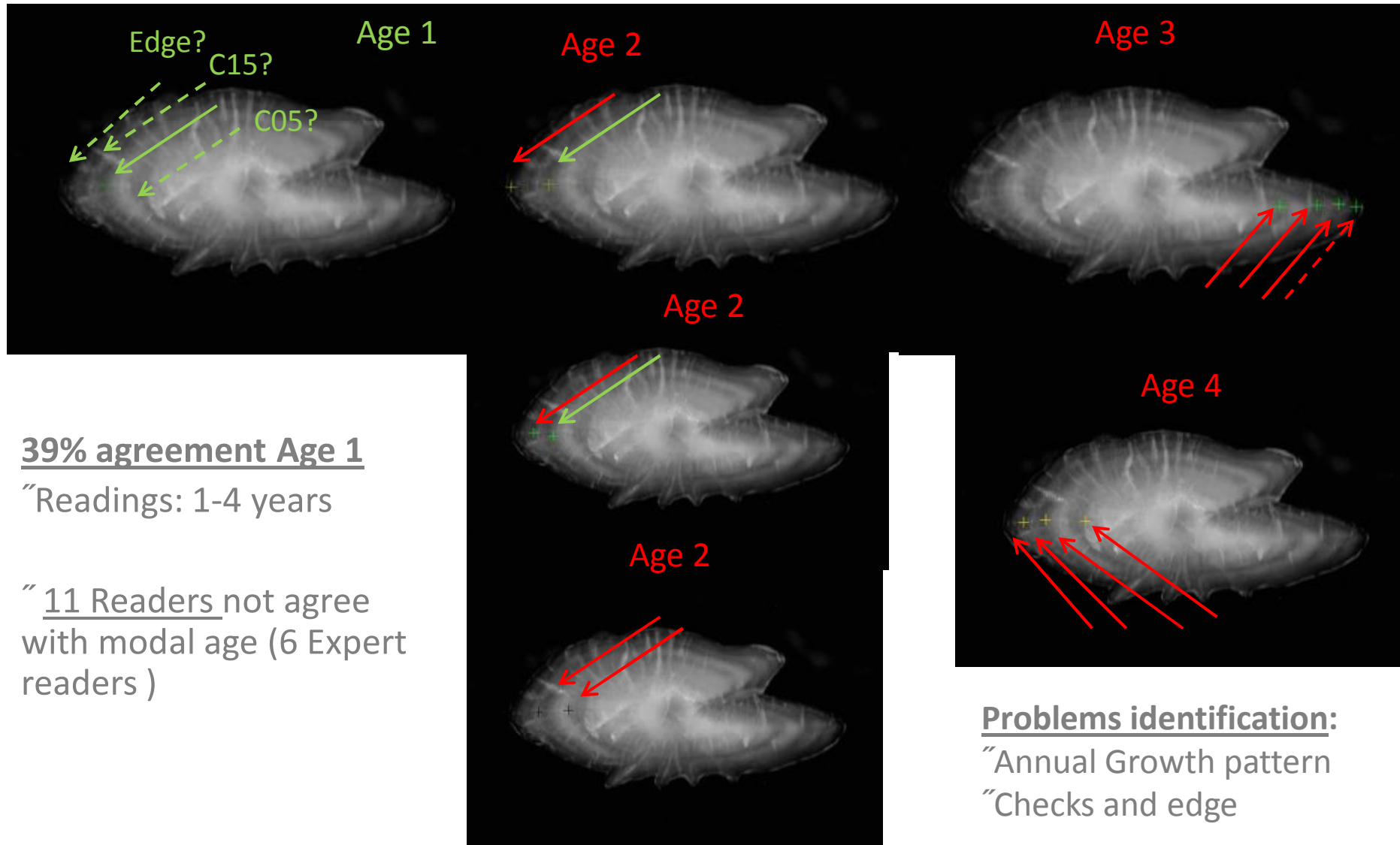
Problems identification:

"Edge

"Confusion with the conventional birthday

Southern Tyrrhenian- GSA10

Age Reading GSA10_14.jpg:
12.5 cm, female, caught September 2012,
Conventional birthdates: 1st July



39% agreement Age 1

“Readings: 1-4 years

“11 Readers not agree
with modal age (6 Expert
readers)

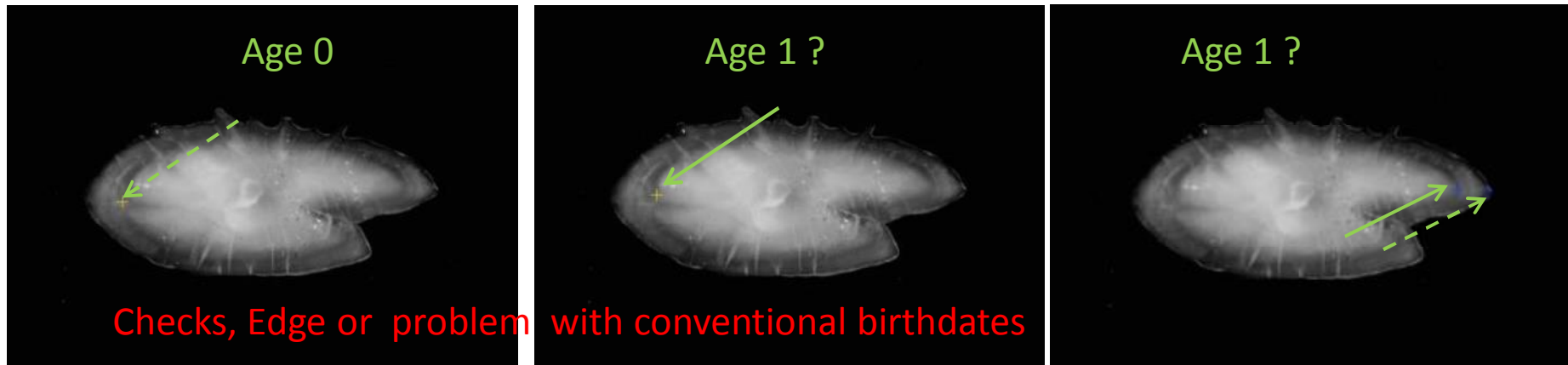
Problems identification:

“Annual Growth pattern

“Checks and edge

Southern Tyrrhenian- GSA10

Age Reading GSA10_53.jpg:
9.5 cm, female, caught May 2012,
Conventional birthdates: 1st July



56% agreement Age 1

“Readings: 0-1 years

“ 8 Readers not agree with modal age (3 Expert readers)

“ Modal Age 0 for Expert Readers

“ Modal Age 1 for Area Readers

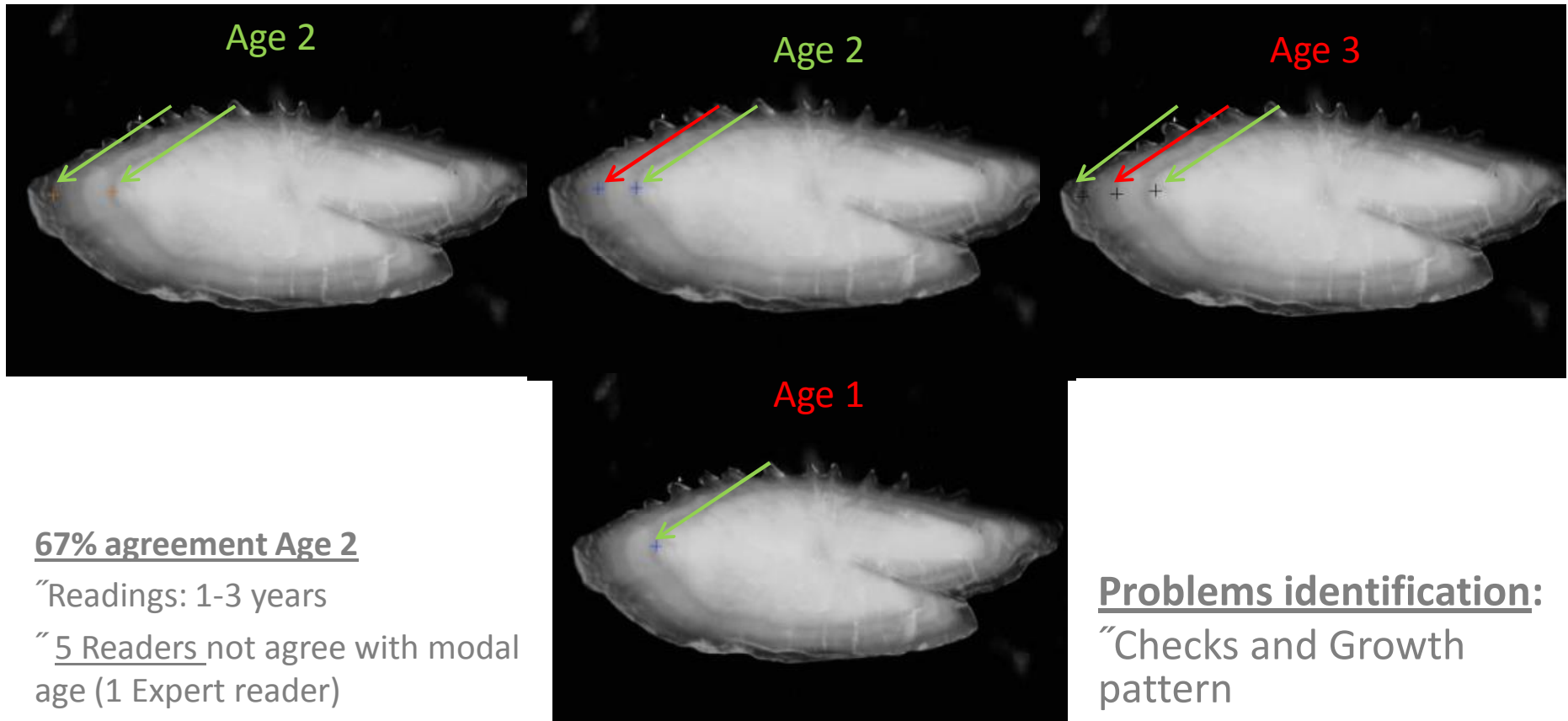
Problems identification:

“Checks

“Edge or confusion with conventional birthday

Southern Tyrrhenian- GSA10

Age Reading GSA10_10.jpg:
14.0 cm, male, caught August 2013,
Conventional birthdates: 1st July



67% agreement Age 2

“Readings: 1-3 years

“5 Readers not agree with modal age (1 Expert reader)

“Modal Age 2 for Expert Readers

“Modal Age 3 for Area Readers

Problems identification:

“Checks and Growth pattern

“Edge or confusion with conventional birthday

Strait of Sicily-GSA16

% Agreement range	No Otoliths	%
17-60%	39	59%
61-80%	21	32%
81-95%	6	9%
100%	0	0%
Total	66	

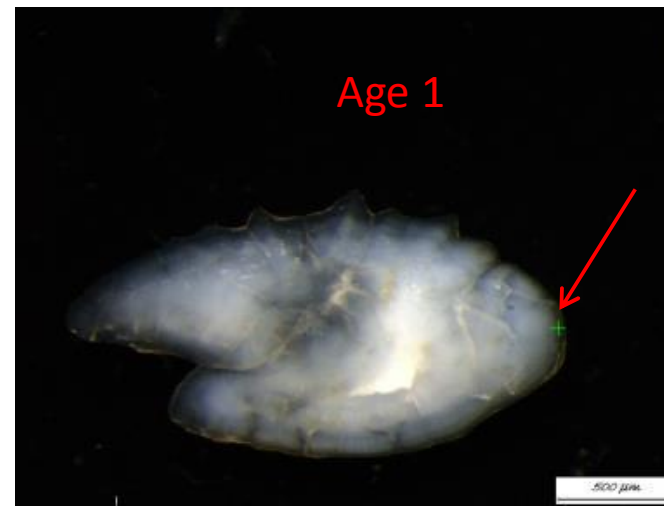
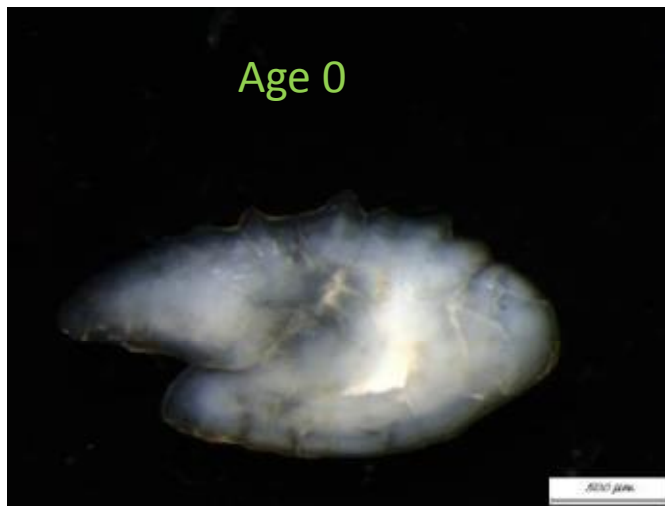
91% of Agreement < 80%

9% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	12	18%
2 age	25	38%
3 age	28	42%
4 age	1	2%

Strait of Sicily-GSA16

Age Reading CB2010(10-5-10)_15(40x).jpg:
9.8 cm, undefined, caught May 2010,
Conventional birthdates: 1st July



94% agreement Age 0

"Readings: 0-1 years

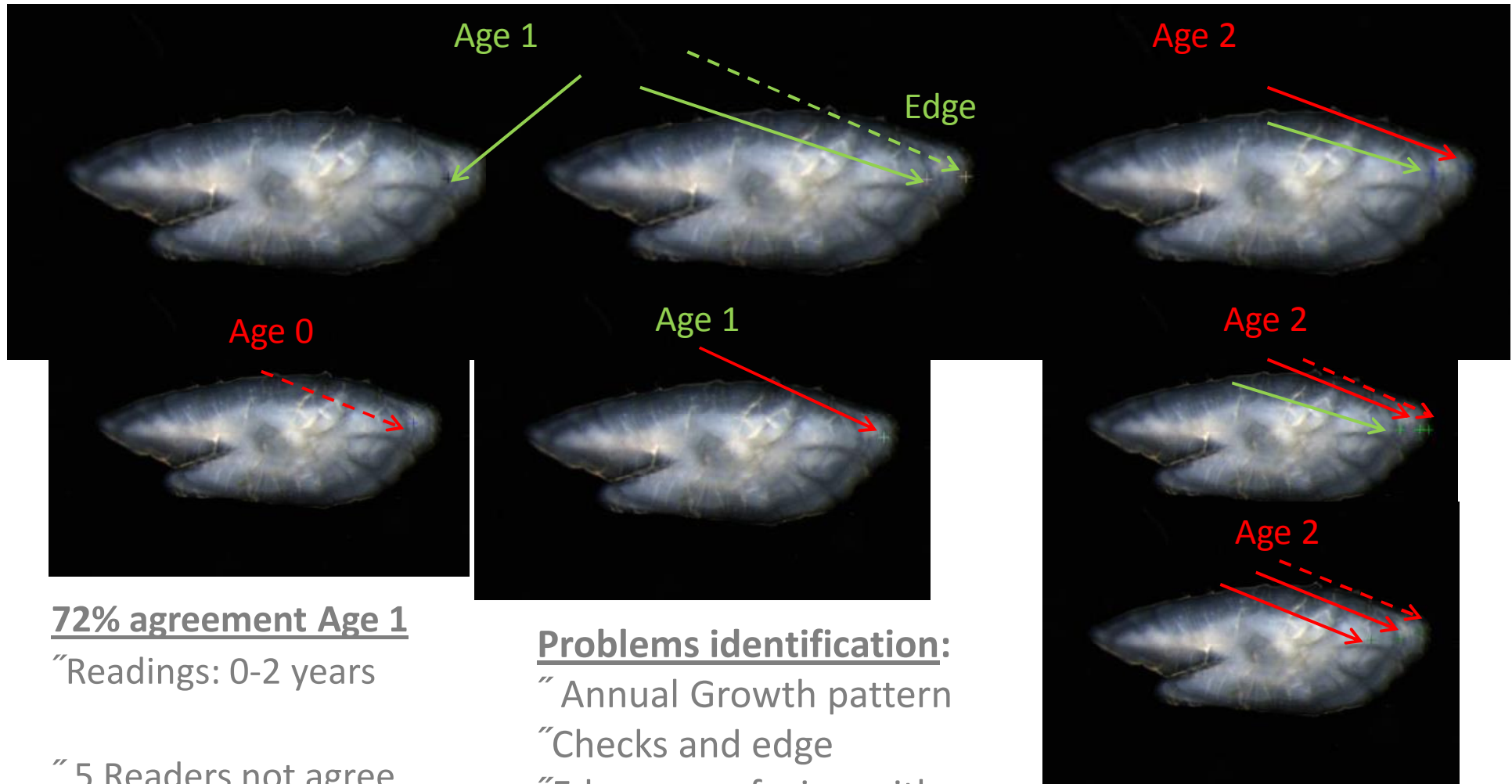
"1 Readers not agree
with modal age (Expert
reader)

Problems identification:

"Edge or confusion with
conventional birthday

Strait of Sicily-GSA16

Age Reading CB2010(13-4-10)_5(32x).jpg:
13.1 cm, male, caught April 2010,
Conventional birthdates: 1st July



72% agreement Age 1

“Readings: 0-2 years

“5 Readers not agree
with modal age (4 Expert
readers)

Problems identification:

“ Annual Growth pattern
“ Checks and edge
“ Edge or confusion with
conventional birthday

Strait of Sicily-GSA16

Age Reading CB2010(6-9-10)_2(32x).jpg:
14.6 cm, male, caught September 2010,
Conventional birthdates: 1st July



39% agreement Age 2

“Readings: 1-4 years

“ 13 Readers not agree
with modal age (6 Expert
readers)

Problems identification:

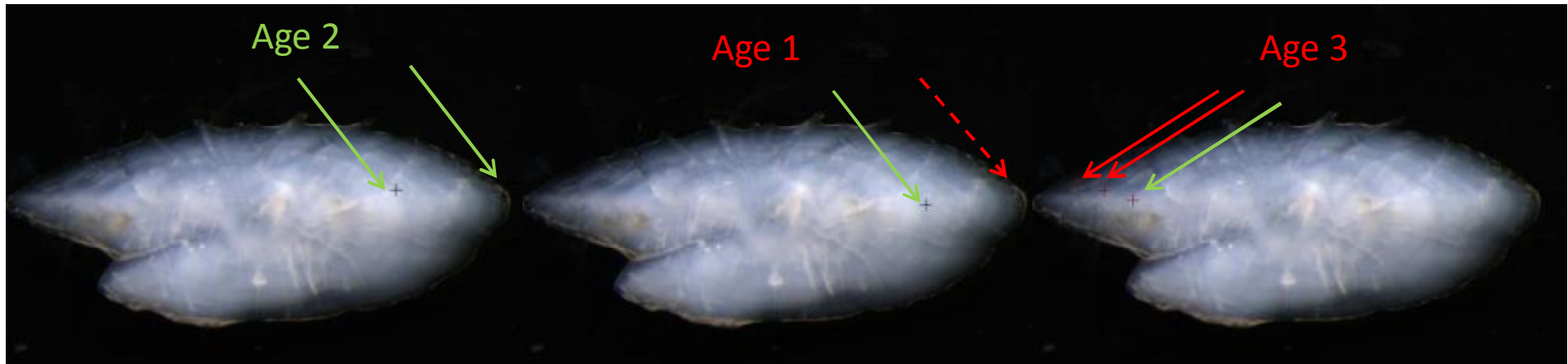
“ Annual Growth pattern

“ Checks and edge

“ Edge or confusion with
conventional birthday

Strait of Sicily-GSA16

Age Reading CB2010(6-9-10)_1(32x).jpg:
14.7 cm, male, caught September 2010,
Conventional birthdates: 1st July



39% agreement Age 2

"Readings: 1-4 years

" 13 Readers not agree with modal age (7 Expert readers)

" Modal Age 3 for Area Readers

" Modal Age 1 for Expert Readers

Problems identification:

" Annual Growth pattern

" Checks and edge

" Edge or confusion with conventional birthday



Western Ionian-GSA19

% Agreement range	No Otoliths	%
44-60%	19	35%
61-80%	35	64%
81-95%	1	2%
100%	0	0%
Total	55	

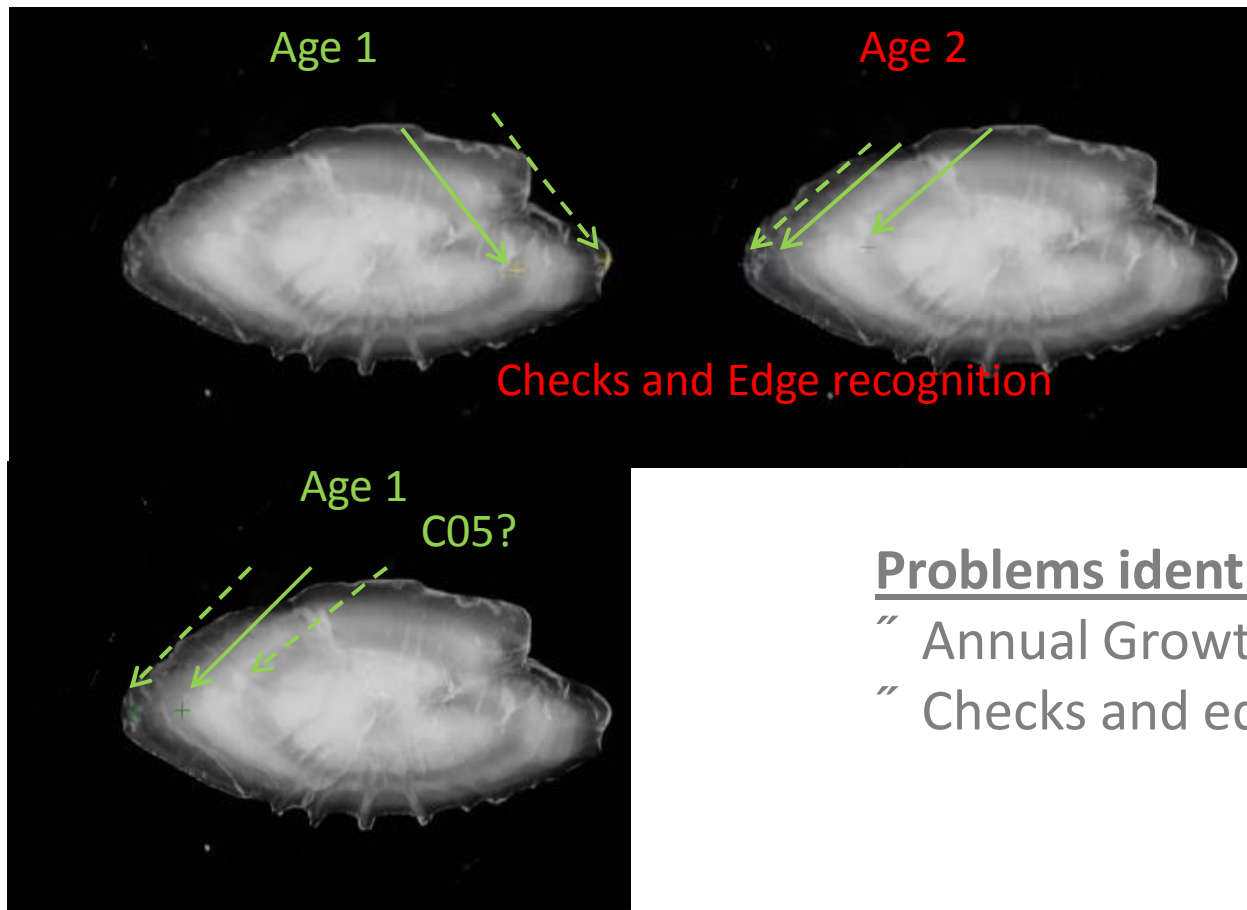
99% of Agreement < 80%

1% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	26	47%
2 age	27	49%
3 age	2	4%

Western Ionian-GSA19

Age Reading GSA19_35.jpg:
13.0 cm, female, caught May 2012,
Conventional birthdates: 1st July



83% agreement Age 1

“Readings: 1-2 years

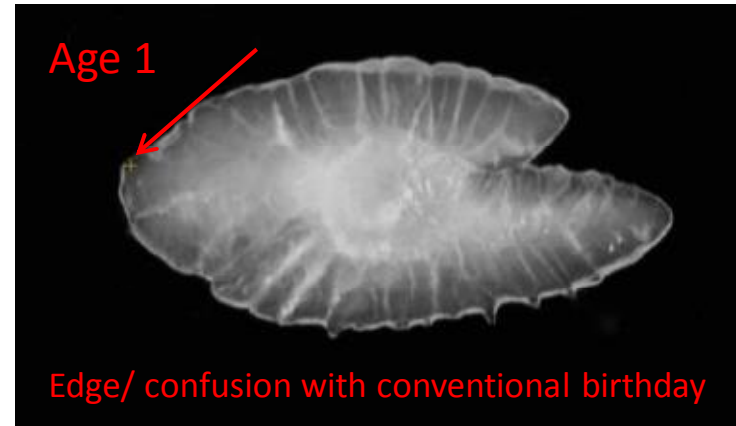
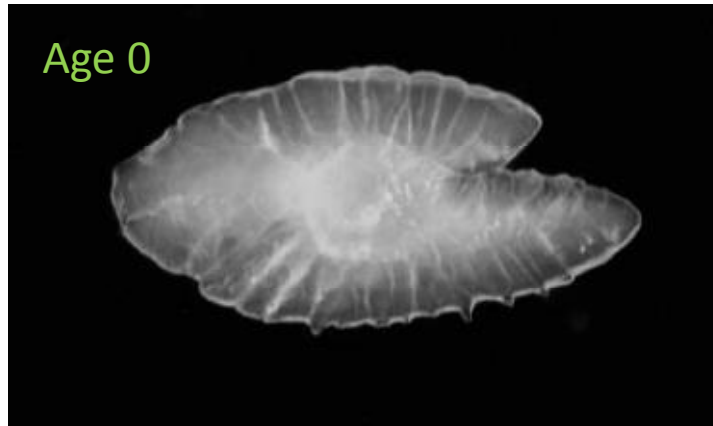
“ 3 Readers not agree
with modal age (all
Expert readers)

Problems identification:

- “ Annual Growth pattern
- “ Checks and edge

Western Ionian-GSA19

Age Reading GSA19_11.jpg:
8.5 cm, undefined, caught September 2013,
Conventional birthdates: 1st July



72 % agreement Age 0

“Readings: 0-1 years

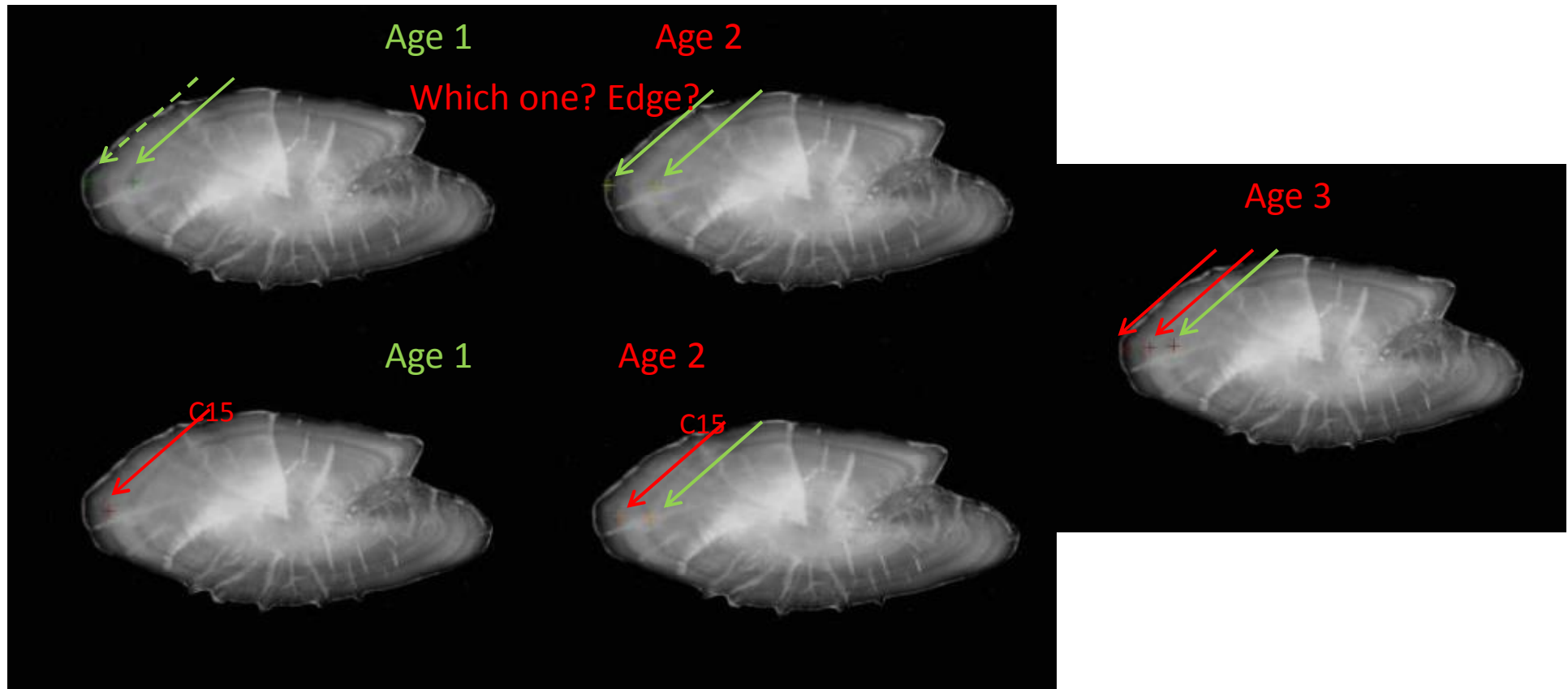
“ 5 Readers not agree
with modal age (3 Expert
readers)

Problems identification:

“ Edge/ confusion with
conventional birthday

Western Ionian-GSA19

Age Reading GSA19_03.jpg:
11.5 cm, female, caught August 2013,
Conventional birthdates: 1st July



44% agreement Age 1

“Readings: 1-3 years

“ 10 Readers not agree with modal age (5 Expert readers)

Problems identification:

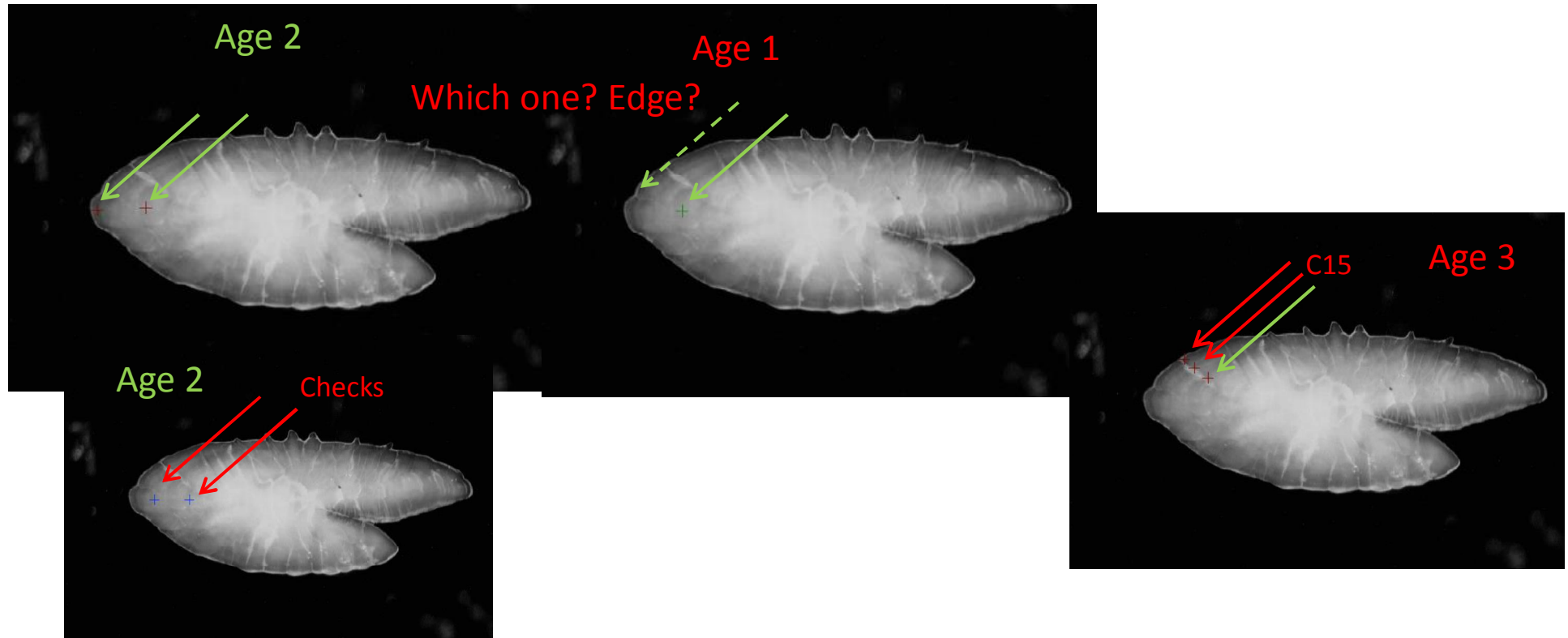
“ Edge/ confusion with conventional birthday

“ Annual growth Pattern

“ Checks

Western Ionian-GSA19

Age Reading GSA19_28.jpg:
13.5 cm, female, caught September 2012,
Conventional birthdates: 1st July



50% agreement Age 2

"Readings: 1-3 years

"9 Readers not agree with modal age (6 Expert readers)

"Modal Age 2 for Area Readers

"Modal Age 1 for Expert Readers

Problems identification:

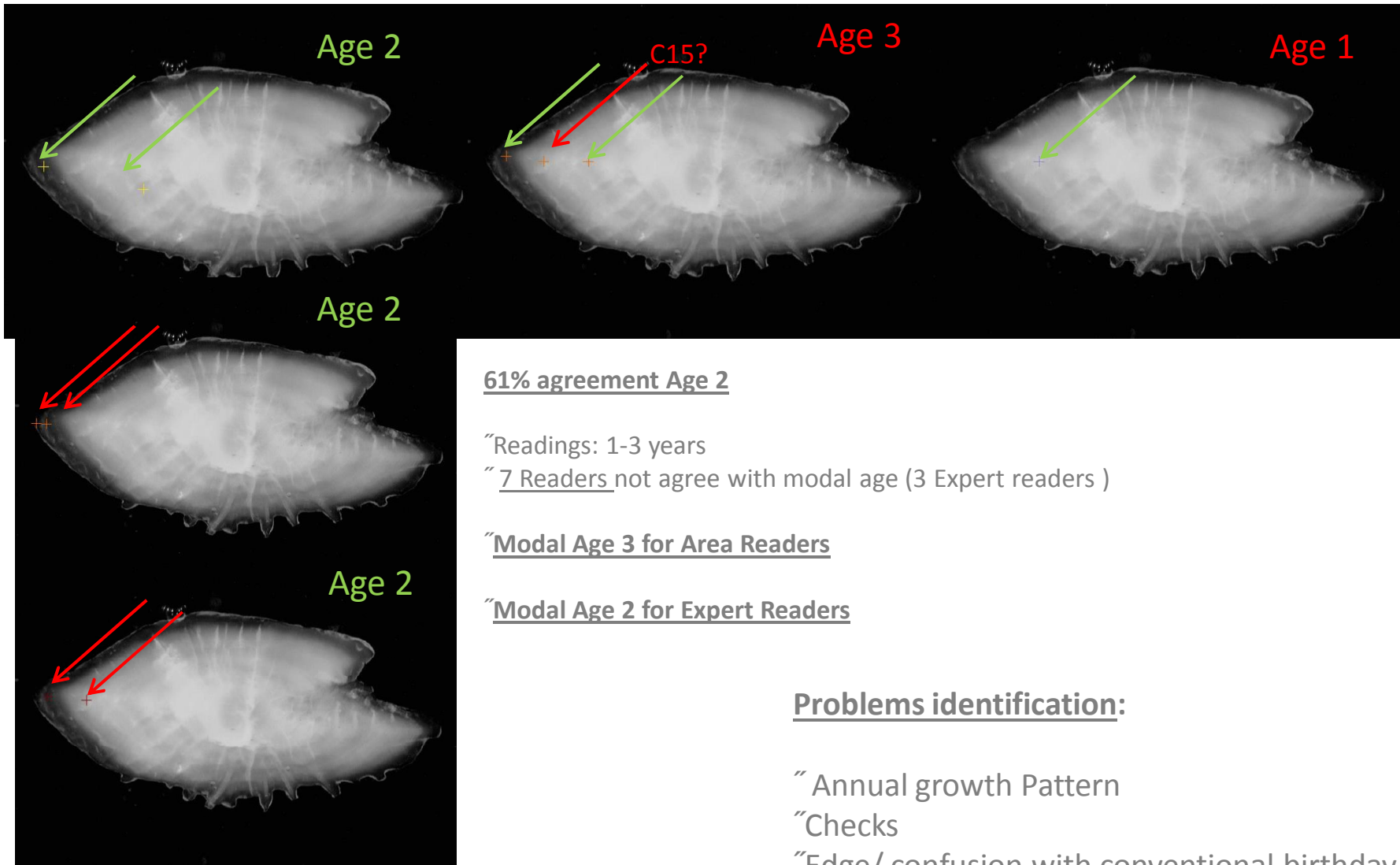
" Edge/ confusion with conventional birthday

"Annual growth Pattern

"Checks

Western Ionian-GSA19

Age Reading GSA19_04.jpg:
13.5 cm, male, caught August 2013,
Conventional birthdates: 1st July



61% agreement Age 2

"Readings: 1-3 years

" 7 Readers not agree with modal age (3 Expert readers)

" Modal Age 3 for Area Readers

" Modal Age 2 for Expert Readers

Problems identification:

" Annual growth Pattern

" Checks

" Edge/ confusion with conventional birthday

Aegean Sea-GSA22

% Agreement range	No Otoliths	%
55-60%	9	13%
61-80%	50	71%
81-95%	11	16%
100%	0	0%
Total	70	

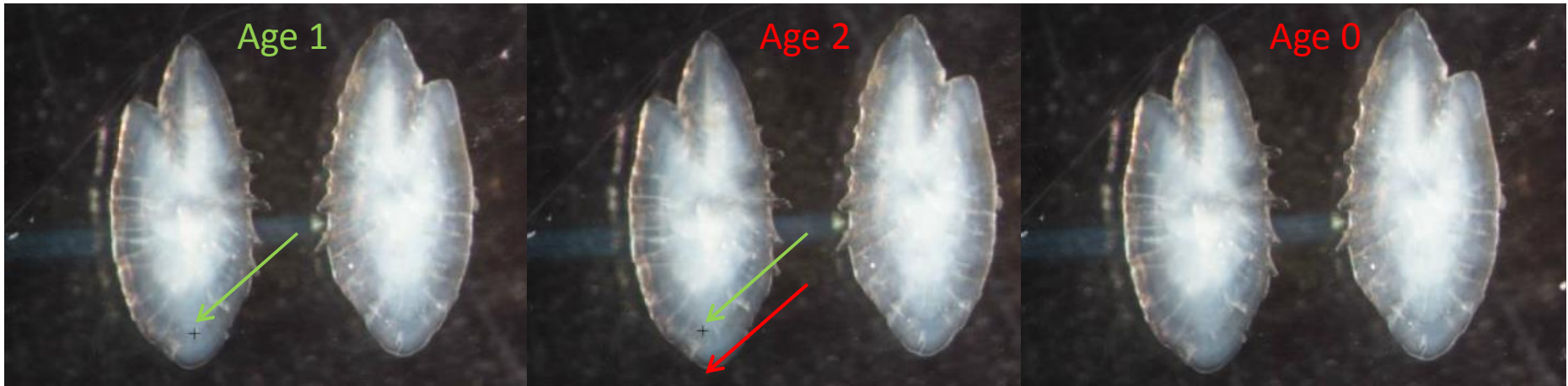
84% of Agreement < 80%

16% of Agreement >80%

Difference age range	Nº Otoliths	%
0 age	0	0%
1 age	66	94%
2 age	4	6%
3 age	0	0%

Aegean Sea-GSA22

Age Reading ANE20062014_1_20.jpg:
9.5 cm, female, caught June 2014,
Conventional birthdates: 1st June



83% agreement Age 1

“Readings: 0-2 years

“3 Readers not agree with modal age (all training)

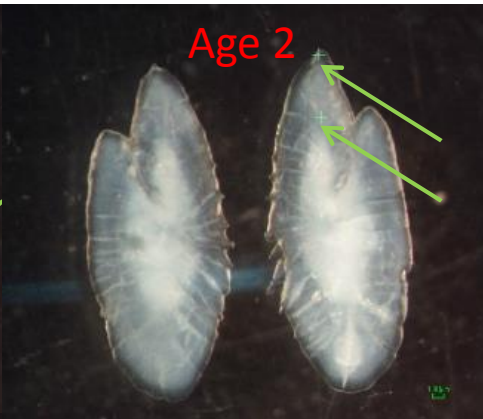
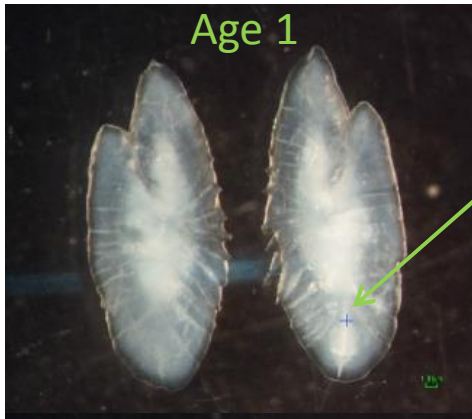
Problems identification:

“ Annual growth Pattern

“Edge/ confusion with conventional birthday

Aegean Sea-GSA22

Age Reading ANE25092014_4_08.jpg:
12.6 cm, female, caught September 2014,
Conventional birthdates: 1st June



Which one? Edge?

72% agreement Age 1

“Readings: 1-2 years

“5 Readers not agree with modal age (2 Expert reader)

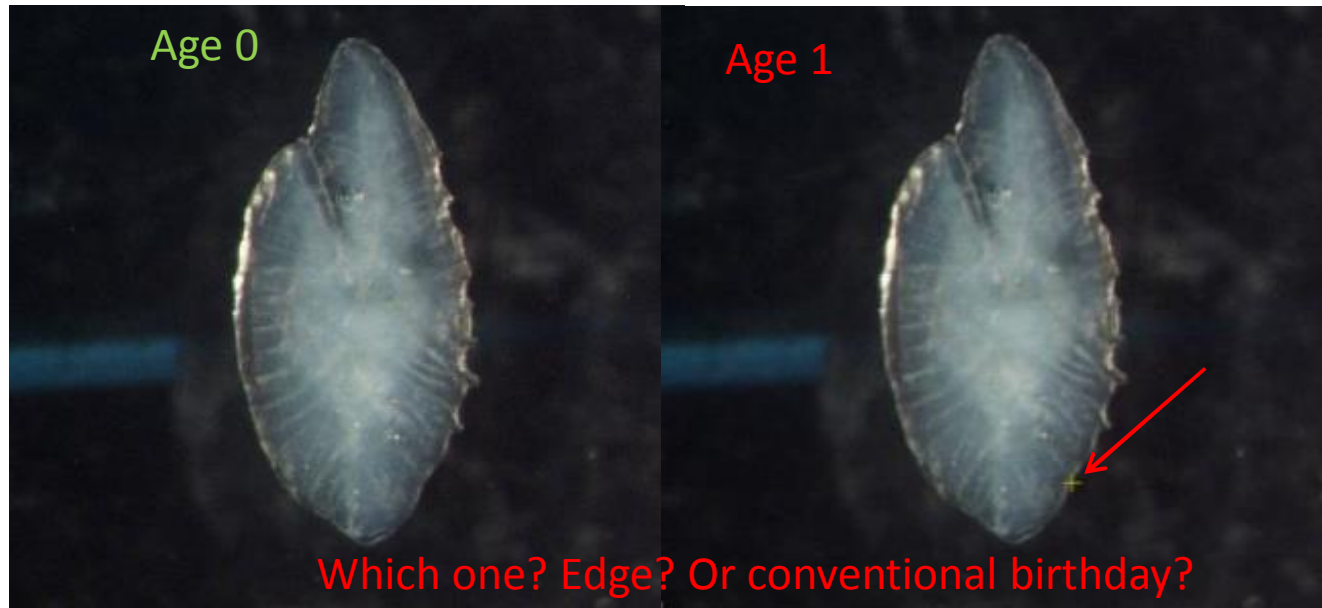
Problems identification:

“ Annual growth Pattern

“ Edge/ confusion with conventional birthday

Aegean Sea-GSA22

Age Reading ANE20062014_1_49.jpg:
9.0 cm, male, caught June 2014,
Conventional birthdates: 1st June



50% agreement Age 0

“Readings: 0-1 years

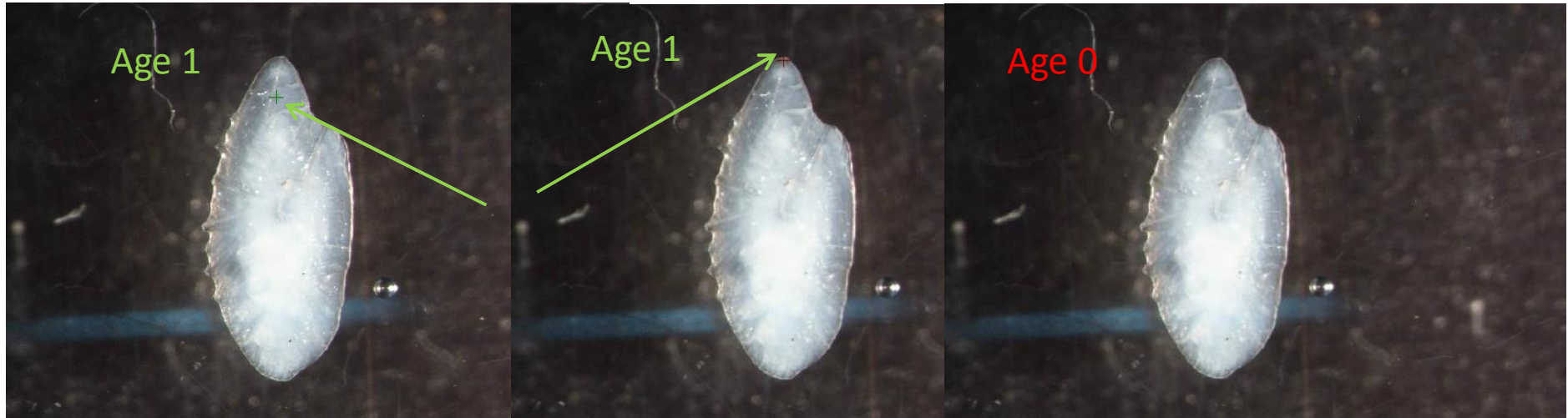
“9 Readers not agree with modal age (5 Expert reader)

Problems identification:

“ Edge/ confusion with conventional birthday?”

Aegean Sea-GSA22

Age Reading ANE20062014_1_18.jpg:
10.5 cm, male, caught June 2014,
Conventional birthdates: 1st June



72% agreement Age 1

"Readings: 0-1 years

"5 Readers not agree with modal age (2 Expert reader)

"Modal Age 0 for Area Readers

"Modal Age 1 for Expert Readers

Problems identification:

"Annual growth pattern

"Edge/ confusion with conventional birthday?

Conclusions

- ✓ The percentage differences in the age range is very high:

Difference age range	English Channel	Bay of Biscay	Division Ixa	Alboran Sea	Western Mediterranean	Gulf of Lion	Southern Tyrrhenian	Strait of Sicily	Western Ionian	Aegean Sea
0 age	0%	3%	1%	0%	0%	8%	0%	0%	0%	0%
1 age	15%	37%	37%	11%	13%	45%	44%	18%	47%	94%
2 age	45%	51%	47%	40%	46%	47%	55%	38%	49%	6%
3 age	30%	9%	15%	43%	49%	0%	2%	42%	4%	0%
4 age	10%	0%	0%	6%	0%	0%	0%	2%	0%	0%

- ✓ Difficulties in differentiating between true annual rings and false rings (or checks), mainly the first annual ring
- ✓ Insufficient typical annual growth pattern recognition and insufficient criteria regarding the otolith edge that can be expected to be seen along the year
- ✓ In addition it is observed that the different conventional birth dates between areas (in the Atlantic in January and in the Mediterranean in June or July) produces some difficulties for some readers (including expert readers) in determining the ages (mainly at ages 0) when the reader changes the conventional birthday which is accustomed.