

Results SmartDots event 295 Internal Wageningen Marine Research training

Larvae used

During the workshop 56 larvae were identified, 12 fresh larvae under the microscope and 44 images were analysed. The images were analysed in the SmartDots training event [295](#). The 12 fresh larvae were validated from rearing experiments and consisted only of herring and sprat. These larvae were also photographed and added to the images. The remaining 32 images were taken from the ICES Workshop 2 on the identification of clupeid larvae (WKIDCLUP2; event [291](#) on SmartDots). These larvae came from various experiments, areas and surveys in the Baltic, North Sea and Atlantic and were all considered to be validated.

The results are presented in three ways: fresh larvae only, images only and a comparison between the fresh larvae and the images of these larvae.

Participants

All participants are from Wageningen Marine Research (WMR) and considered experts, and all provide data for the assessment. The results are presented anonymous, but participants have access to their own results.

To be able to use the identification results for herring larvae and the MIK surveys, results are also presented for small (≤ 17 mm) and large (> 17 mm) larvae, corresponding to mean larvae length found in the samples of the different surveys.

Results

Tables 1 to 3 give the overview of the results of the species identification of all fresh larvae identified under the microscope (Table 1), small (Table 2) and large larvae (Table 3). Table 4 to 6 give the overview of the results of the species identification of all larvae from images in SmartDots. Table A contains the numbers per species which each participant based on the real species should have identified. If a participant did not identify all larvae this is shown in the total number identified. The larvae that were not identified by a participant are not considered to calculate the agreement. Table B shows the quantity per species which was actually identified. The total columns at the end of table A and B are shown for information for the overall estimations of over- or underestimation and agreement. Table C shows the over- or underestimation of the identification by participant in table B compared to Table A, and table D shows the agreement in identification by species.

Table 2. Species identification of small (≤ 17 mm) fresh larvae comparable to larvae in samples from the herring larvae surveys.

A Species compositions using actual species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|----------------|----------|----------|----------|----------|----------|-------|
| Herring | 4 | 4 | 4 | 4 | 4 | 20 |
| Pilchard | - | - | - | - | - | - |
| Sprat | 2 | 2 | 2 | 2 | 2 | 10 |
| Sandeel | 4 | - | - | - | - | - |
| Anchovy | 5 | - | - | - | - | - |
| Other | 8 | - | - | - | - | - |
| Unknown | 9 | - | - | - | - | - |
| Total | 1-9 | 6 | 6 | 6 | 6 | 30 |

B Species compositions as estimated per participant and whole group

| Species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|----------|----------|----------|----------|----------|----------|-------|
| Herring | 4 | 4 | 4 | 4 | 4 | 20 |
| Pilchard | 0 | 0 | 0 | 0 | 0 | - |
| Sprat | 2 | 2 | 2 | 2 | 2 | 10 |
| Sandeel | 4 | 0 | 0 | 0 | 0 | - |
| Anchovy | 5 | 0 | 0 | 0 | 0 | - |
| Other | 8 | 0 | 0 | 0 | 0 | 0 |
| Unknown | 9 | 0 | 0 | 0 | 0 | - |
| Total | 1-9 | 6 | 6 | 6 | 6 | 30 |

C Percentage overestimation / underestimation

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL |
|----------------|----------|----------|----------|----------|----------|-----|
| Herring | 1 | 0% | 0% | 0% | 0% | 0% |
| Pilchard | 2 | - | - | - | - | - |
| Sprat | 3 | 0% | 0% | 0% | 0% | 0% |
| Sandeel | 4 | - | - | - | - | - |
| Anchovy | 5 | - | - | - | - | - |
| Other | 8 | - | - | - | - | - |
| Unknown | 9 | - | - | - | - | - |

D Percentage agreement in species identification per species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL |
|----------------|----------|----------|----------|----------|----------|--------|
| Herring | 1 | 100% | 100% | 100% | 100% | 100% |
| Pilchard | 2 | - | - | - | - | - |
| Sprat | 3 | 100% | 100% | 100% | 100% | 100% |
| Sandeel | 4 | - | - | - | - | - |
| Anchovy | 5 | - | - | - | - | - |
| Other | 8 | - | - | - | - | - |
| Unknown | 9 | - | - | - | - | - |
| Weighted mean | 1-9 | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | | 1 | 1 | 1 | 1 | 1 |

Table 3. Species identification of large (> 17 mm) fresh larvae comparable to larvae in samples from the MIK surveys.

A Species compositions using actual species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|----------------|----------|----------|----------|----------|----------|-------|
| Herring | 4 | 4 | 4 | 4 | 4 | 20 |
| Pilchard | - | - | - | - | - | - |
| Sprat | 2 | 2 | 2 | 2 | 2 | 10 |
| Sandeel | - | - | - | - | - | - |
| Anchovy | - | - | - | - | - | - |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |
| Total | 1-9 | 6 | 6 | 6 | 6 | 30 |

B Species compositions as estimated per participant and whole group

| Species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|----------|----------|----------|----------|----------|----------|-------|
| Herring | 2 | 3 | 2 | 3 | 2 | 12 |
| Pilchard | 1 | 1 | 2 | 1 | 2 | 7 |
| Sprat | 3 | 2 | 2 | 2 | 2 | 11 |
| Sandeel | 0 | 0 | 0 | 0 | 0 | - |
| Anchovy | 0 | 0 | 0 | 0 | 0 | - |
| Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Unknown | 0 | 0 | 0 | 0 | 0 | - |
| Total | 1-9 | 6 | 6 | 6 | 6 | 30 |

C Percentage overestimation / underestimation

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL |
|----------------|----------|----------|----------|----------|----------|------|
| Herring | -50% | -25% | -50% | -25% | -50% | -40% |
| Pilchard | - | - | - | - | - | - |
| Sprat | 50% | 0% | 0% | 0% | 0% | 10% |
| Sandeel | - | - | - | - | - | - |
| Anchovy | - | - | - | - | - | - |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |

D Percentage agreement in species identification per species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL |
|----------------|----------|----------|----------|----------|----------|-------|
| Herring | 50% | 75% | 50% | 75% | 50% | 60% |
| Pilchard | - | - | - | - | - | - |
| Sprat | 100% | 100% | 100% | 100% | 100% | 100% |
| Sandeel | - | - | - | - | - | - |
| Anchovy | - | - | - | - | - | - |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |
| Weighted mean | 66.7% | 83.3% | 66.7% | 83.3% | 66.7% | 73.3% |
| | 3 | 1 | 3 | 1 | 3 | |

Table 5. Species identification of all images with small (≤ 17 mm) larvae comparable to larvae in samples from the herring larvae surveys.

A Species compositions using actual species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|----------------|------------|-----------|-----------|-----------|-----------|------------|
| Herring | 10 | 10 | 10 | 10 | 10 | 50 |
| Pilchard | 7 | 7 | 7 | 7 | 7 | 35 |
| Sprat | 3 | 3 | 3 | 3 | 3 | 15 |
| Sandeel | 3 | 3 | 3 | 3 | 3 | 15 |
| Anchovy | 9 | 9 | 9 | 9 | 9 | 45 |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |
| Total | 1-9 | 32 | 32 | 32 | 32 | 160 |

B Species compositions as estimated per participant and whole group

| Species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|--------------|------------|-----------|-----------|-----------|-----------|------------|
| Herring | 12 | 11 | 10 | 11 | 9 | 53 |
| Pilchard | 0 | 8 | 6 | 8 | 8 | 30 |
| Sprat | 1 | 0 | 7 | 5 | 4 | 17 |
| Sandeel | 2 | 1 | 2 | 0 | 0 | 5 |
| Anchovy | 0 | 8 | 5 | 1 | 8 | 22 |
| Other | 1 | 0 | 0 | 0 | 0 | 0 |
| Unknown | 9 | 16 | 4 | 2 | 3 | 32 |
| Total | 1-9 | 32 | 32 | 32 | 32 | 160 |

C Percentage overestimation / underestimation

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL | |
|----------------|----------|----------|----------|----------|----------|-------|------|
| Herring | 1 | 20% | 10% | 0% | 10% | -10% | 6% |
| Pilchard | 2 | -100% | 14% | -14% | 14% | 14% | -14% |
| Sprat | 3 | -67% | -100% | 133% | 67% | 33% | 13% |
| Sandeel | 4 | -33% | -67% | -33% | -100% | -100% | -67% |
| Anchovy | 5 | -100% | -11% | -44% | -89% | -11% | -51% |
| Other | 8 | - | - | - | - | - | - |
| Unknown | 9 | - | - | - | - | - | - |

D Percentage agreement in species identification per species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL | |
|----------------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Herring | 1 | 50% | 90% | 100% | 80% | 90% | 82% |
| Pilchard | 2 | 0% | 71% | 71% | 71% | 100% | 63% |
| Sprat | 3 | 0% | 0% | 100% | 67% | 100% | 53% |
| Sandeel | 4 | 67% | 33% | 67% | 0% | 0% | 33% |
| Anchovy | 5 | 0% | 89% | 56% | 11% | 89% | 49% |
| Other | 8 | - | - | - | - | - | - |
| Unknown | 9 | - | - | - | - | - | - |
| Weighted mean | 1-9 | 21.9% | 71.9% | 78.1% | 50.0% | 84.4% | 61.3% |
| | | 5 | 3 | 2 | 4 | 1 | |

Table 6. Species identification of all images of large (> 17 mm) larvae comparable to larvae in samples from the MIK surveys.

A Species compositions using actual species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|----------------|----------|----------|----------|----------|----------|-------|
| Herring | 8 | 8 | 8 | 8 | 8 | 40 |
| Pilchard | - | - | - | - | - | - |
| Sprat | 4 | 4 | 4 | 4 | 4 | 20 |
| Sandeel | - | - | - | - | - | - |
| Anchovy | - | - | - | - | - | - |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |
| Total | 1-9 | 12 | 12 | 12 | 12 | 60 |

B Species compositions as estimated per participant and whole group

| Species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | TOTAL |
|--------------|----------|----------|----------|----------|----------|-------|
| Herring | 2 | 7 | 6 | 6 | 8 | 29 |
| Pilchard | 0 | 1 | 1 | 2 | 1 | 5 |
| Sprat | 0 | 3 | 4 | 3 | 2 | 12 |
| Sandeel | 0 | 0 | 0 | 0 | 0 | - |
| Anchovy | 0 | 0 | 0 | 0 | 1 | 1 |
| Other | 1 | 0 | 0 | 0 | 0 | 0 |
| Unknown | 9 | 1 | 1 | 1 | 0 | 12 |
| Total | 1-9 | 12 | 12 | 12 | 12 | 60 |

C Percentage overestimation / underestimation

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL |
|----------------|----------|----------|----------|----------|----------|------|
| Herring | -75% | -13% | -25% | -25% | 0% | -28% |
| Pilchard | - | - | - | - | - | - |
| Sprat | -100% | -25% | 0% | -25% | -50% | -40% |
| Sandeel | - | - | - | - | - | - |
| Anchovy | - | - | - | - | - | - |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |

D Percentage agreement in species identification per species

| Actual species | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 | ALL |
|----------------------|----------|----------|----------|----------|----------|-------|
| Herring | 25% | 88% | 75% | 75% | 100% | 73% |
| Pilchard | - | - | - | - | - | - |
| Sprat | 0% | 75% | 100% | 75% | 50% | 60% |
| Sandeel | - | - | - | - | - | - |
| Anchovy | - | - | - | - | - | - |
| Other | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - |
| Weighted mean | 16.7% | 83.3% | 83.3% | 75.0% | 83.3% | 68.3% |
| | 5 | 1 | 1 | 4 | 1 | |

All participants thought that the quality of the images was poor to awful. Two participants of this workshop had participated in the WKIDCLUP2 and at that time they were surprised at the quality of the larvae. Most of the images were the same as in WKIDCLUP2 for these two readers, but they appeared of poorer quality. For one reader this could be because another screen with different resolution was used this workshop compared to WKIDCLUP2.

Comparing the results of the fresh larvae to the images, these results do not seem to be as bad as the participants thought themselves (Figure 1). One reader could not identify the larvae from the images, the other four did identify them. For most the larvae that was wrongly identified fresh as pilchard, had a different reading from the images (two actually identified this one correctly as herring from the image).

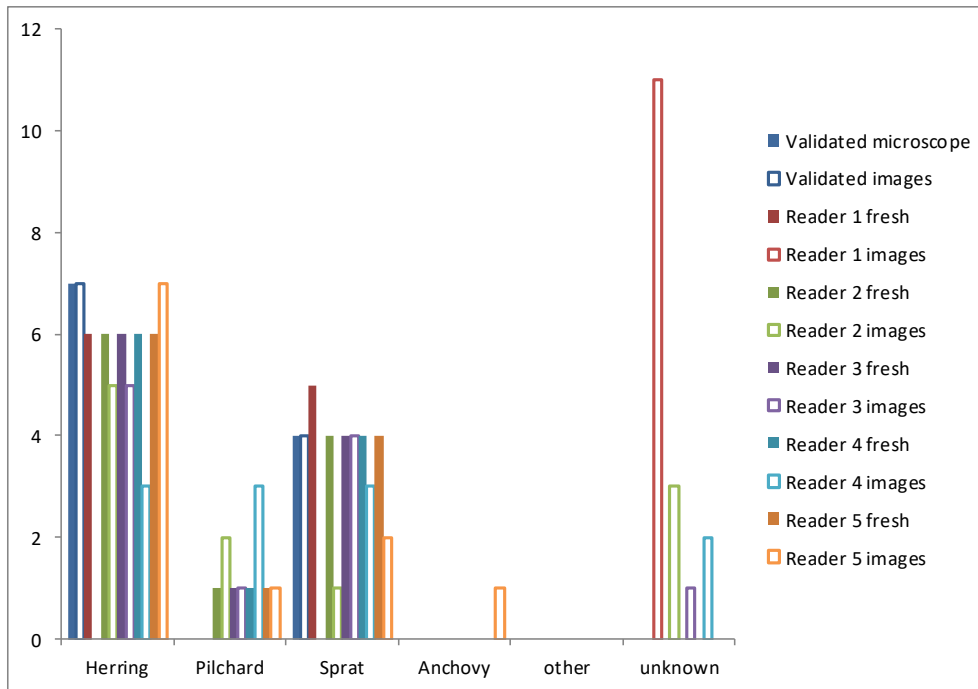


Figure 1. Fresh versus image larvae identification; closed columns are identifications of the fresh larvae, open columns of the images.

Myotome counts are used to identify the clupeid species from each other. First the modal number of myotomes per larva is determined and then the difference per participant in myotomes relative to this mode is estimated. Comparing the larvae that were counted both fresh and from the images the agreement is rather high, where the readers had a high deviation this was caused by one larva where the count was very different, for the other larvae the counts differed only one or two myotomes from each other.

Table 7. Over/underestimation of the number of myotomes comparing the fresh versus the images of the same larvae.

| | Myotomes from head to anus microscope vs image | | | | |
|----------------------|--|----------|----------|----------|----------|
| | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 |
| Mean overall | 2 | 0 | 0 | -1 | -2 |
| STDEV overall | 0.00 | 1.41 | 1.66 | 3.00 | 3.55 |
| Mean small | 2 | 1 | 0 | -1 | 0 |
| STDEV small | | 0.71 | 0.82 | 3.39 | 1.21 |
| Mean large | 2 | 0 | 0 | -2 | -5 |
| STDEV large | | 1.71 | 2.45 | 2.70 | 3.56 |

Length measurements of the larvae are comparable between participants, with low standard deviations (Table 8). Length measurements between the fresh larvae and images did not differ much (Table 12), results were similar to overall results (Table 9). Reader 1 did not do length measurements on the images.

Table 8. Over/underestimation the larvae length relative to the average length.

| | Length | | | | |
|---------------|----------|----------|----------|----------|----------|
| | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 |
| Mean overall | 0 | 0 | 0 | 0 | 0 |
| STDEV overall | 0.72 | 0.41 | 0.57 | 0.57 | 0.65 |
| Mean small | 0 | 0 | 0 | 0 | 0 |
| STDEV small | 0.44 | 0.32 | 0.40 | 0.48 | 0.47 |
| Mean large | -1 | 0 | 0 | 1 | -1 |
| STDEV large | 0.93 | 0.58 | 0.86 | 0.66 | 0.82 |

Table 9. Over/underestimation the larvae length comparing the fresh versus the images of the same larvae.

| | Length | | | | |
|---------------|----------|----------|----------|----------|----------|
| | Reader 1 | Reader 2 | Reader 3 | Reader 4 | Reader 5 |
| Mean overall | | 0 | -1 | 0 | 1 |
| STDEV overall | | 1.03 | 0.62 | 0.55 | 0.26 |
| Mean small | | -1 | -1 | 0 | 1 |
| STDEV small | | 0.68 | 0.75 | 0.57 | 0.36 |
| Mean large | | 1 | -1 | 0 | 1 |
| STDEV large | | 0.84 | 0.39 | 0.54 | 0.08 |

Use of images and SmartDots

The SmartDots event worked fine. It has the advantage that each participant can identify the larvae at its own convenience and more importantly that each participant had the same quality of images. However, it became clear when one reader, who participated in both WKIDCLUP2 and this workshop, thought the images of this workshop were much poorer, that the quality of the screen used by the participants is an important factor that might influence the outcome of these events. In fact this reader was looking at the same images at both workshops but used a different screen the second time. Reader1 found it so difficult to identify the larvae from the images that almost none were identified to species and only few had myotome counts and none had a length measurement.

Probably the fact that participants are not used to identifying larvae from images plays a role. When comparing results of the same larvae identified fresh under the microscope and from images, the differences were not very large, except for one or two outliers. In fact the one larvae that was identified fresh by most readers as pilchard, was correctly identified as herring by some readers from the images. For future workshops it is important to improve the quality of the images, but also make sure that the resolutions of the screens used by the readers is of high quality and similar.