
DTU

“SmartDots – a tool created by the users for the users”

2023 TESA best practices in ageing workshop

January 31st to February 2nd

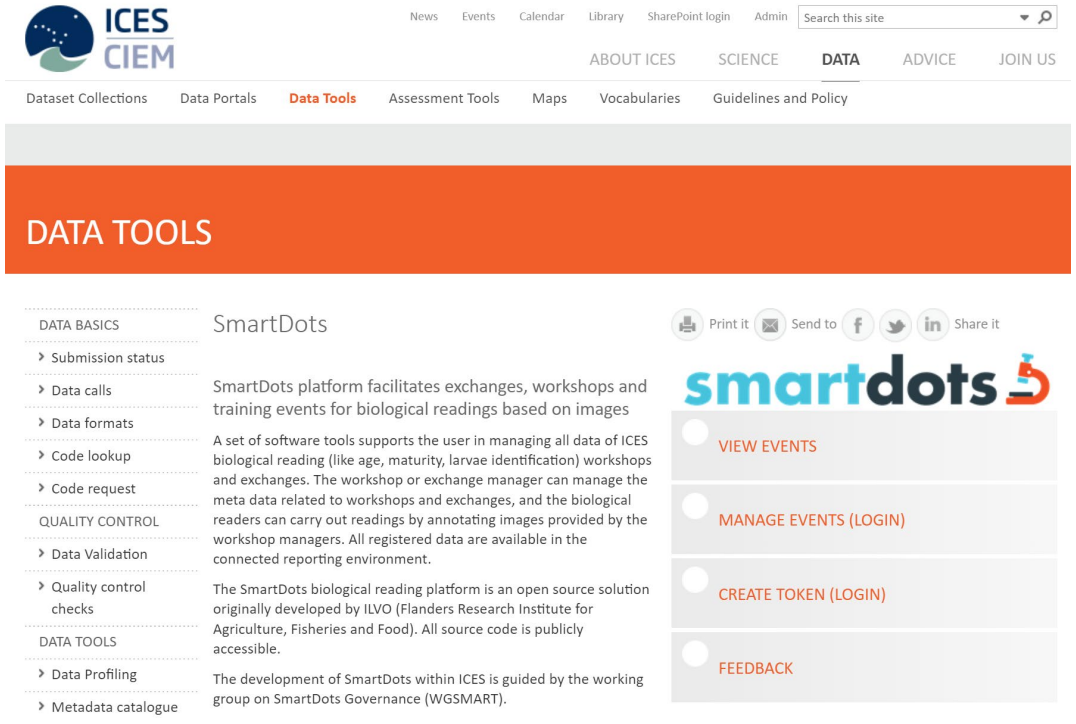
smartdots

- What will the talk cover…
  - Where did SmartDots originate?
  - How is it built?
  - WGSMART
  - New modules in development
  - Training material
  - Reporting module
  - WKAMEMSA
  - DTU’s Aquadots

What is SmartDots?

- A platform for quality assurance of biological parameters as input for stock assessment
- Launched in 2018 - First international ICES age reading exchange
- Managed by The ICES Working Group on SmartDots Governance (WGSMART)
  - Oversee all improvements (https://github.com/ices-eg/SmartDots)
  - Ensure developments are inline with the ICES quality assurance framework (QAF)
  - Close cooperation with the ICES Working Group on Biological Parameters (WGBIOP)

https://www.ices.dk/data/tools/Pages/smartdots.aspx



smartdots

WGBIOP

ICES CIEM

It originated as an….

Age reading platform

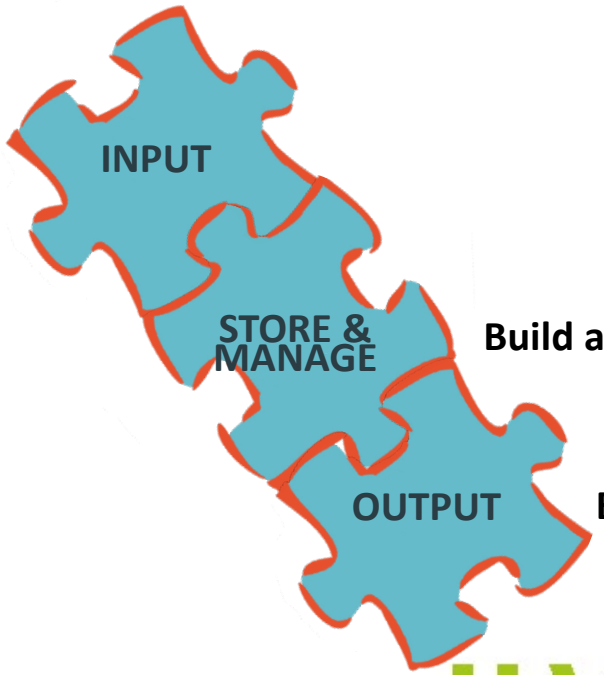
Working Group on Biological Parameters

WGBIOP 2016 approached **ICES Data Centre** proposing:

- an international online platform for age reading exchanges and workshops
- to be used for all ICES age reading calibrations

Adapt the original version of SmartDots

- function for international use (security, servers, open source code…)
- function for exchanges and workshops (new tools and commands…)
- improvements made based on the list of bugs and problems with WebGR



Build a web application and a database

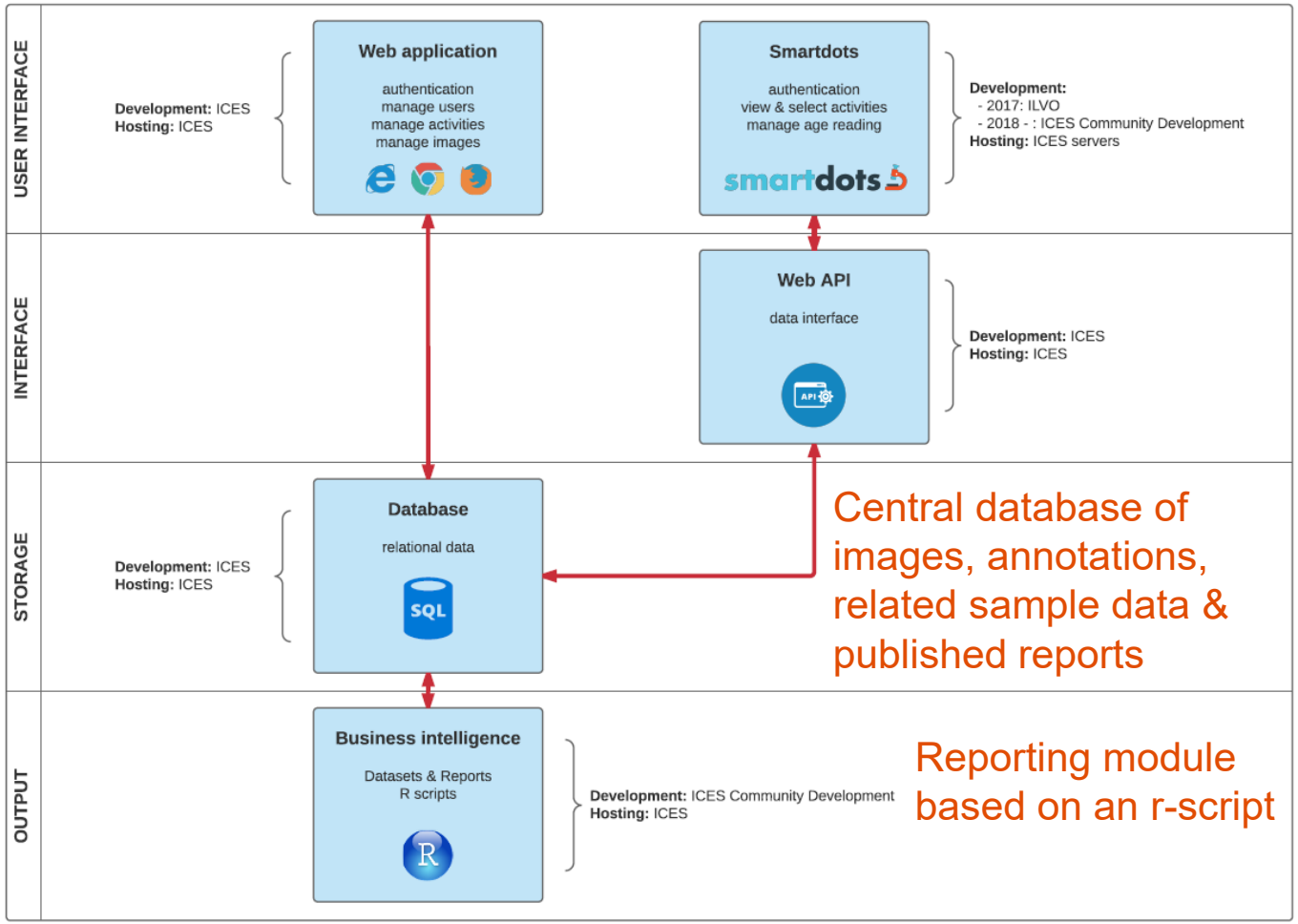
Build a reporting module

ILVO DTU ICES CIEM

Age reading platform

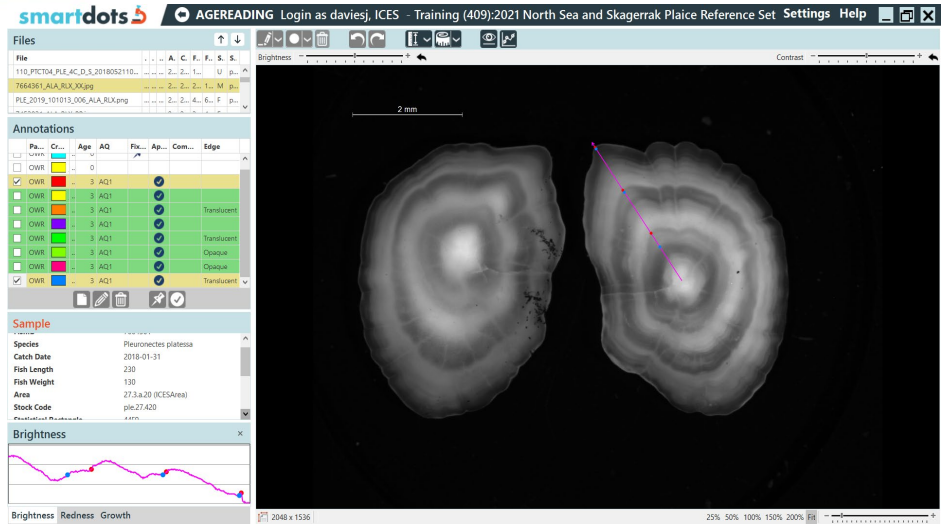
WGBIOP

Working Group on Biological Parameters



Central database of images, annotations, related sample data & published reports

Reporting module based on an r-script



Database of age readers information on species read, type of structure, area/stock and level of experience and contact details

WGSMART

Working Group on SmartDots Governance

WGSMART's purpose - devoted to **overseeing and advising on the improvements needed** to make SmartDots a fully functional tool for *age reading and maturity staging* exchanges, workshops and training exercises

Working in close collaboration with the Working Group on Biological Parameters (WGBIOP) to **identify future opportunities for development of SmartDots as a quality assurance platform.**

26 members from 13 institutes + ICES

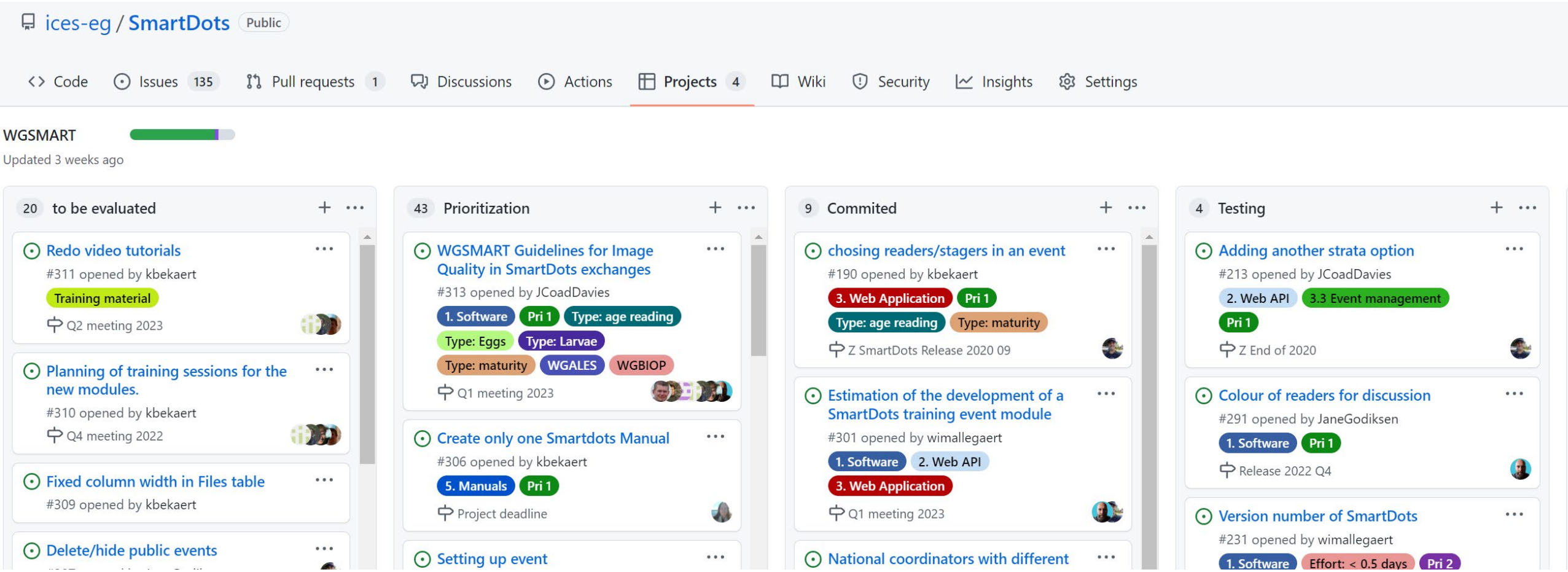
- 2019 - present
- Representing the **core development organisations** and **active** contributors
- Mixed expertise
- Meeting physically once per year (following WGBIOP to discuss and prioritise **feedback**) and quarterly via WebEx.
- Work plan on https://github.com/ices-eg/SmartDots: assigning issues, setting milestones and effort estimations
- Responsible for **newsletter releases, manual updates, training** https://www.youtube.com/@icessmartdots2352/featured

WGSMART

Working Group on SmartDots Governance

A tool built for the users by the users

https://smartdots.ices.dk/Userfeedback

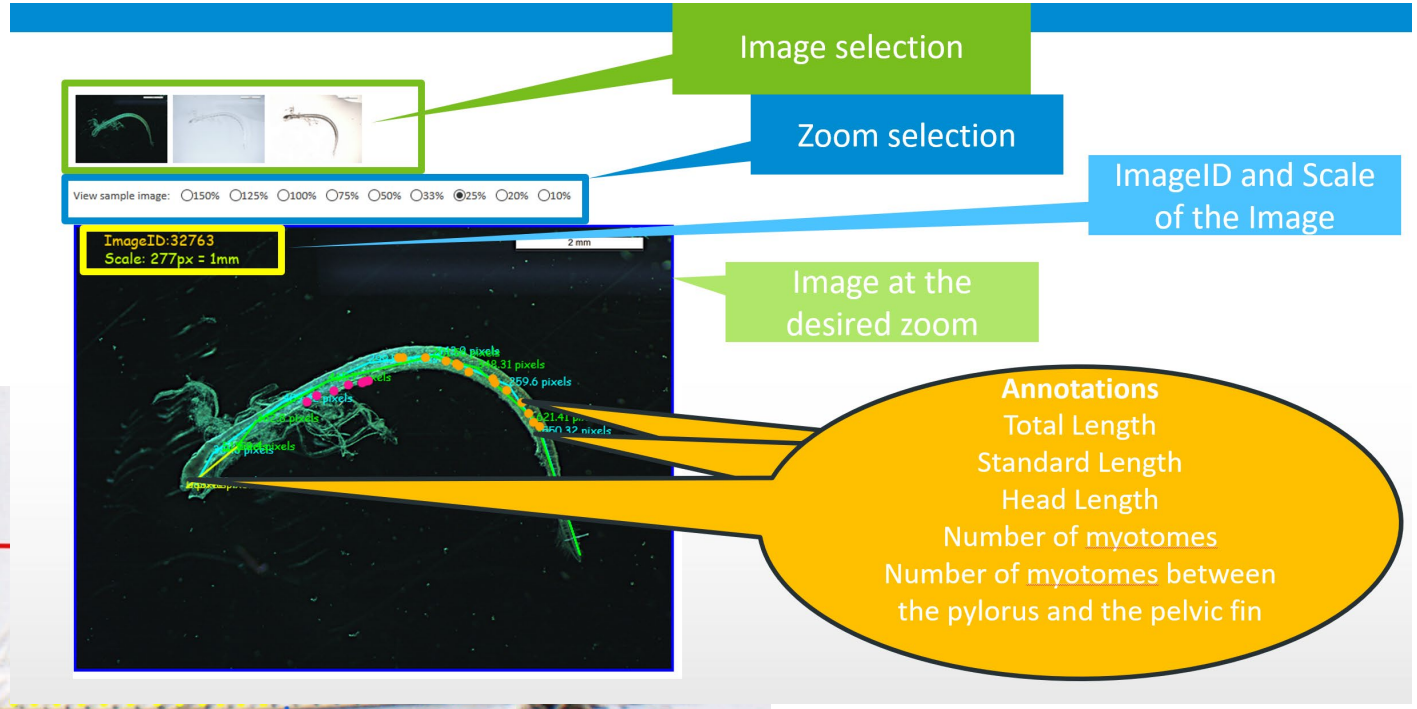


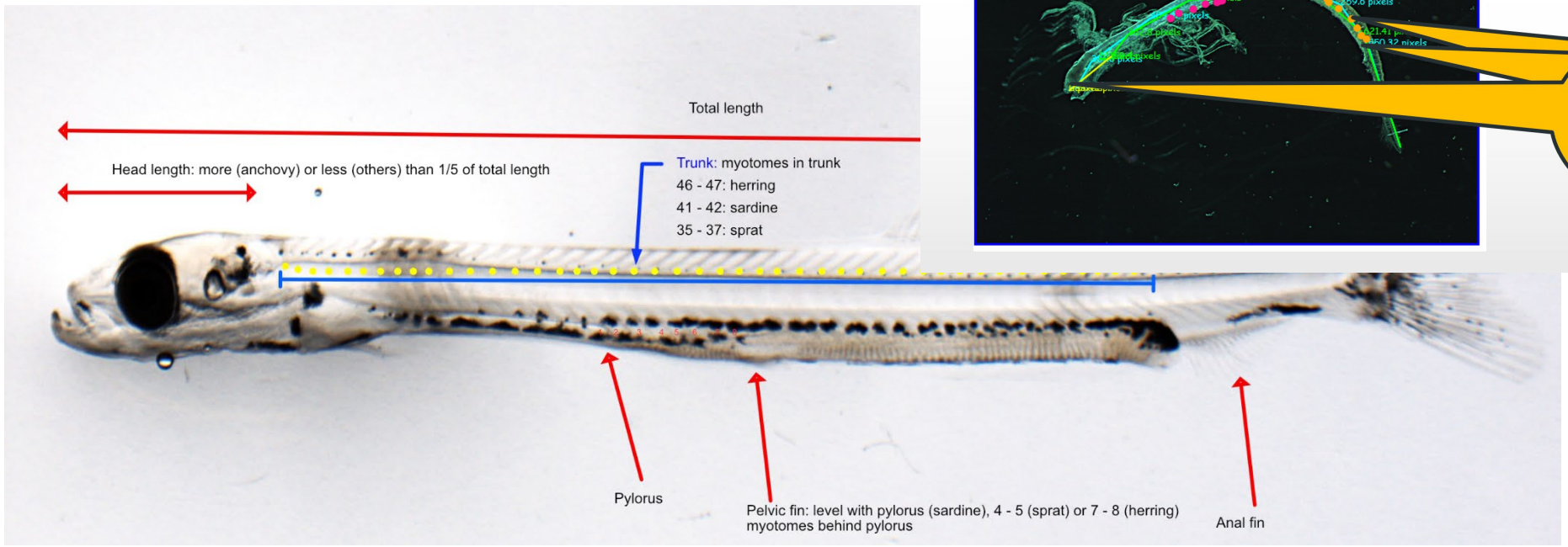
ICES WKIDCLUP2 Workshop 2 on the identification of clupeoid larvae

September 2020 online

Working Group on SmartDots Governance

A larva ID module was created in the web application



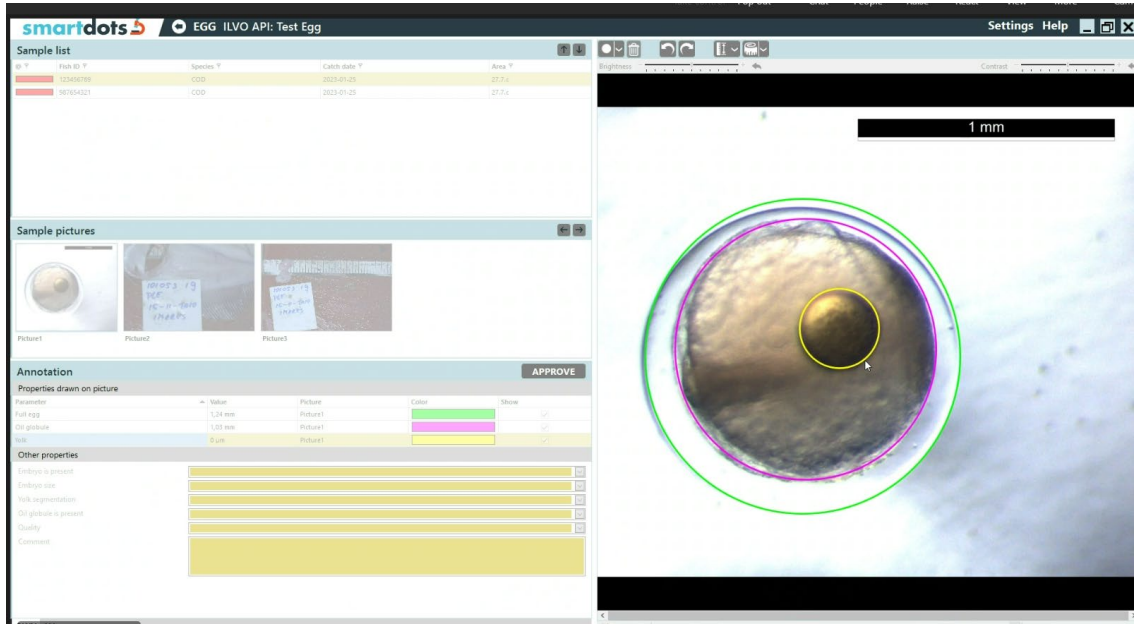


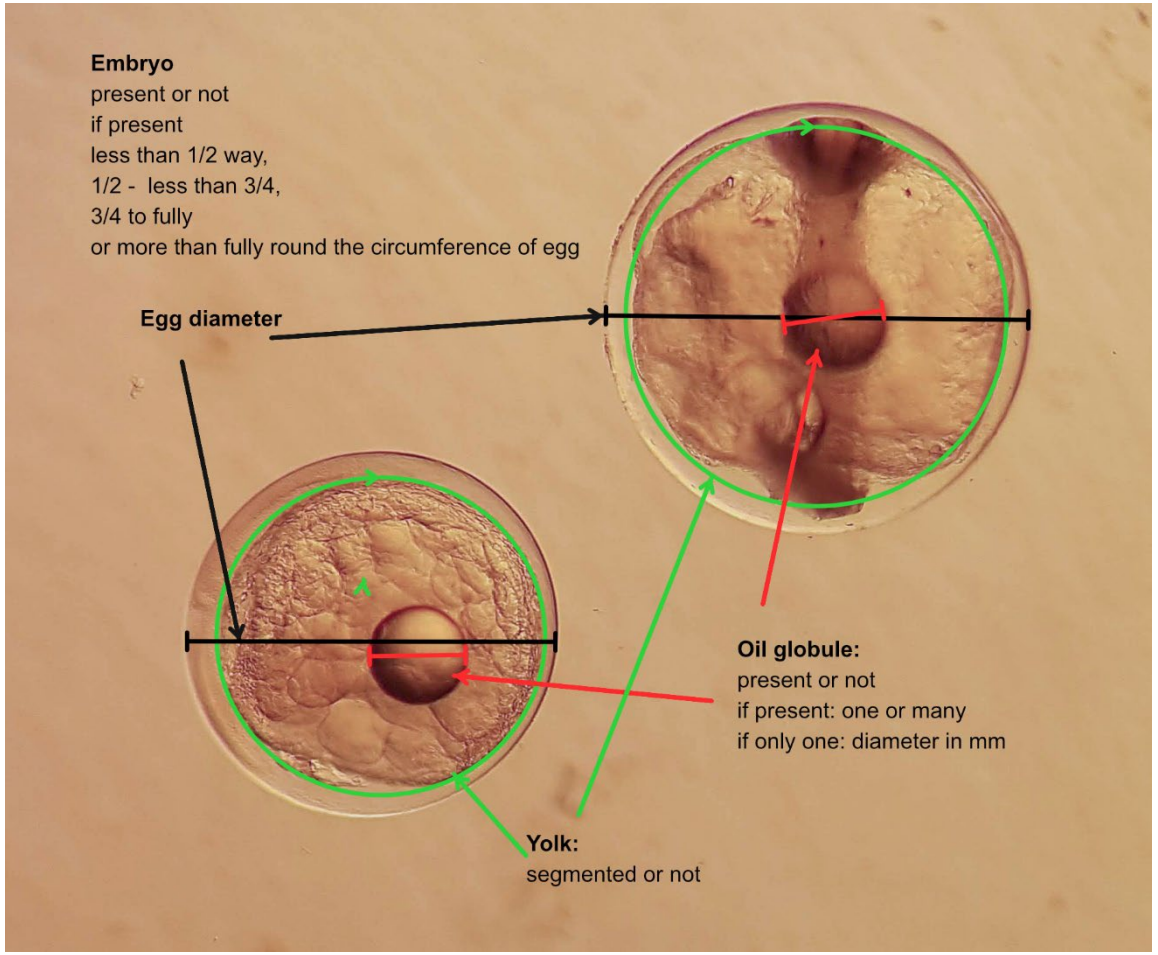
ICES WKMACHIS Workshop on Mackerel, Horse Mackerel and Hake Eggs Identification and Staging

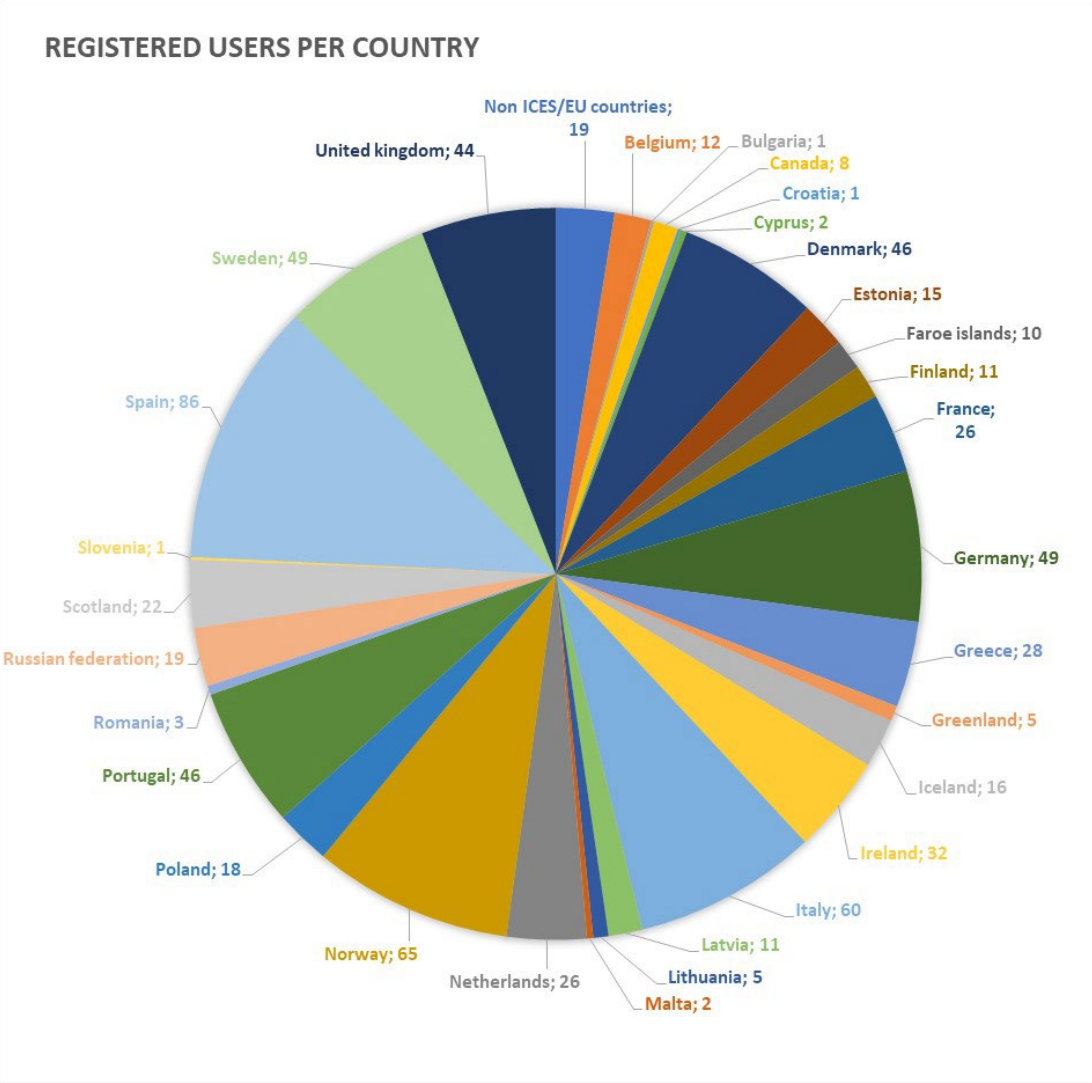
October 2021 online (hybrid?)

Working Group on SmartDots Governance

An egg ID module was created in the web application







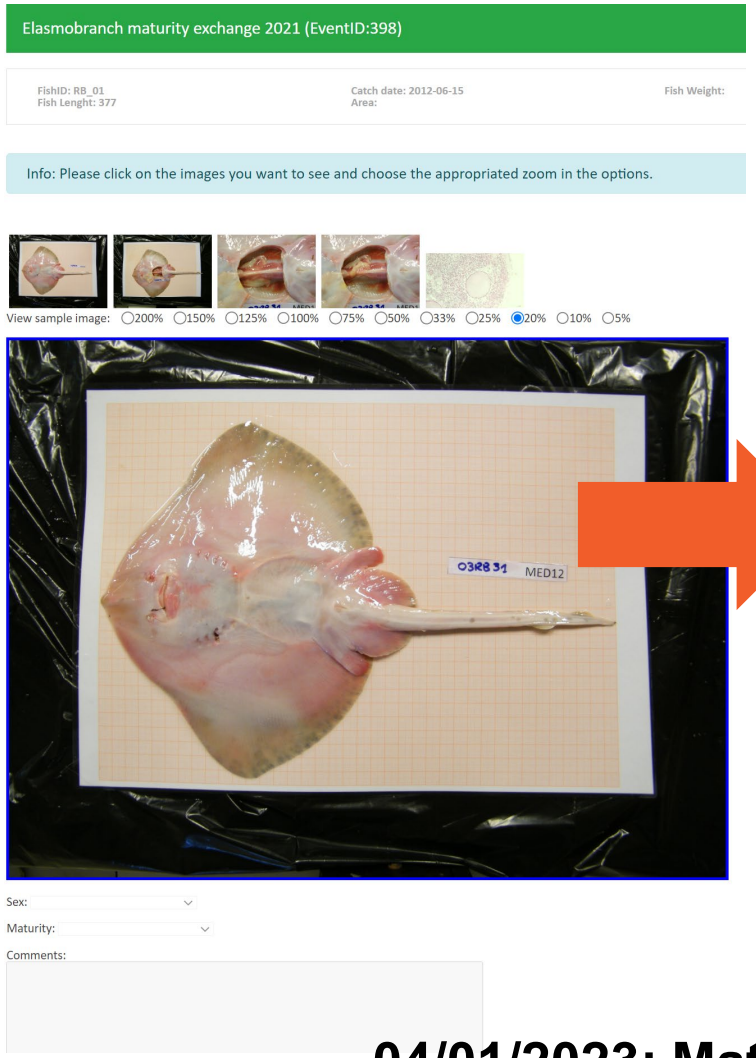
Project underway to answer a special request from DGMARE & UK to ICES to develop additional SmartDots software modules

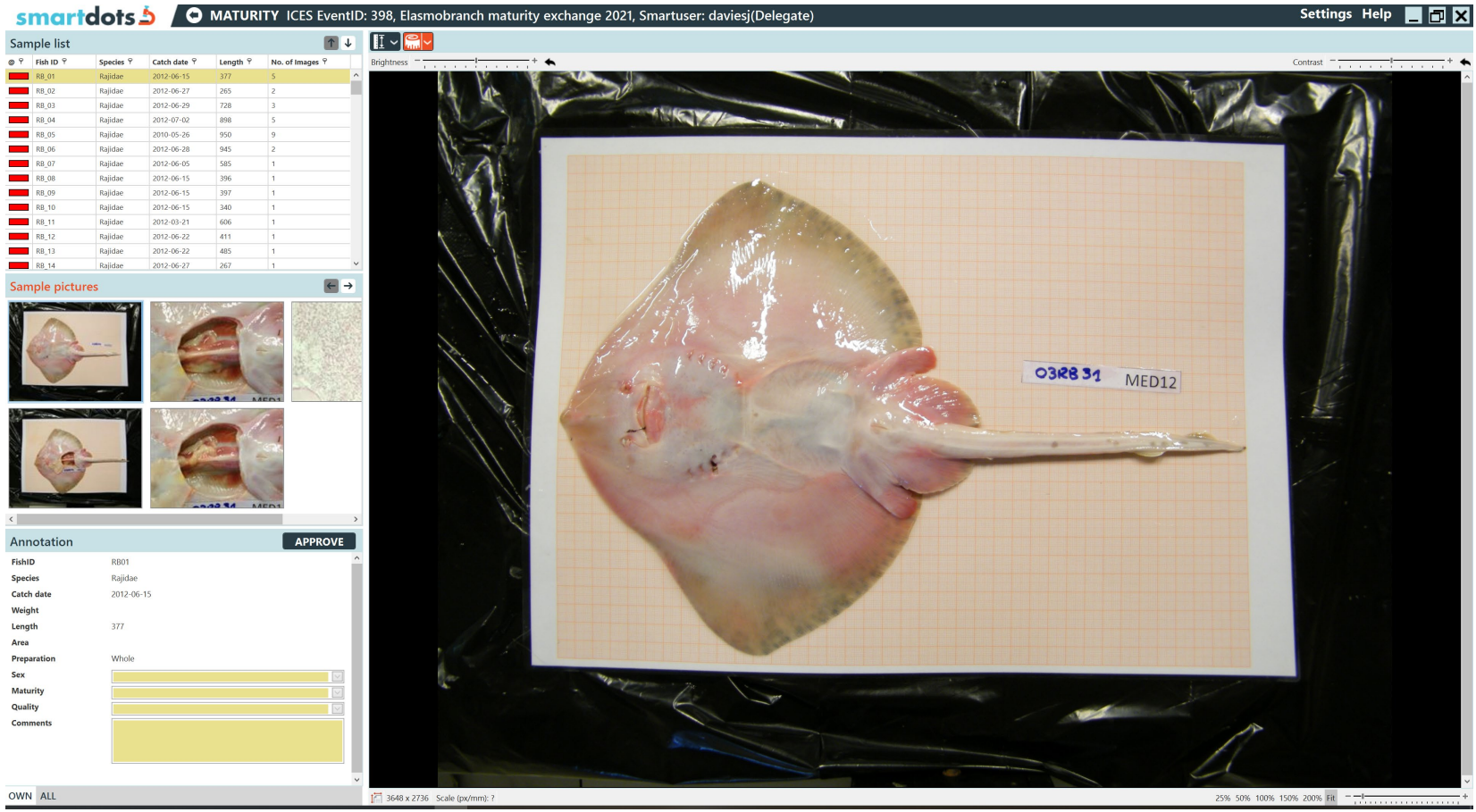
Will be developed individually but will be relying on the work done for the age reading module

The following features are required:

1. Maturity module in the software
2. Larvae module in the software
3. Egg module in the software
4. User training
   a. A 2 day online workshop for coordinators to introduce the new modules.
   b. A series of 3 online training modules for the users.

Working Group on SmartDots Governance

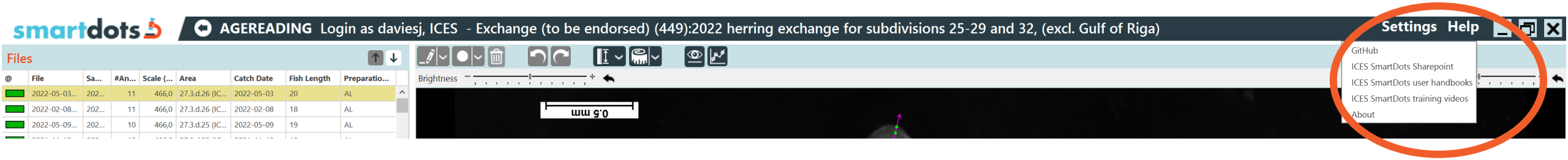




04/01/2023: Maturity module and a new verison of the age reading module released

In any event there are several permission levels

- **Age readers** can make annotations and only have access to their own annotations.
- **Event managers** have access to all annotations (there can be numerous managers).
- **Country coordinators** have automatic access to the event but can only see the annotations of their age readers (they can not make any annotations).



WGSMART

Working Group on SmartDots Governance

https://www.ices.dk/data/tools/Pages/smartdots.aspx

SMARTDOTS

Print it Send to Share it

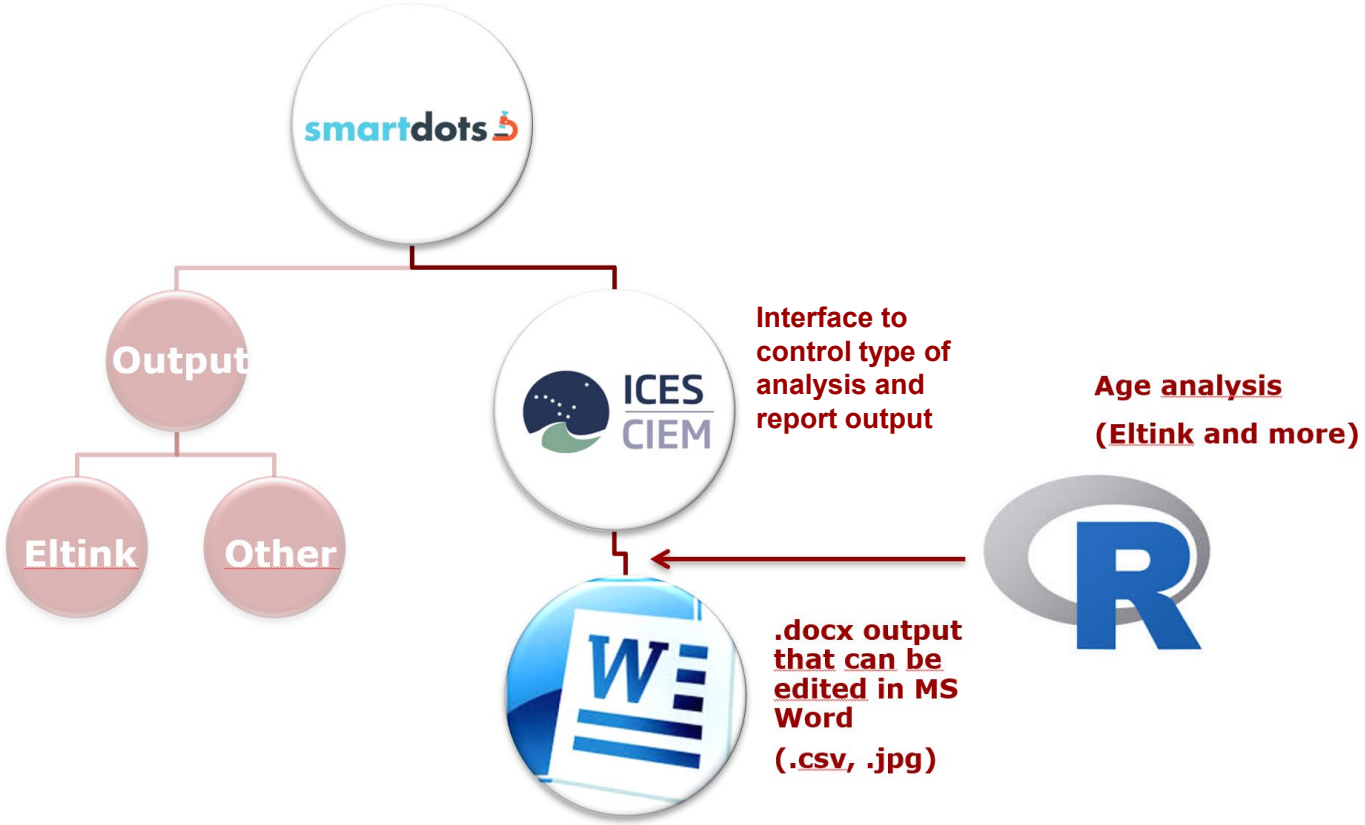
SmartDots > Manage events and users

Below you can see which data are available in the current database. You can choose to:

- Add new users and edit their First Year Age Reading and Number of Years Reading Otoliths
- Setup users expertise (for your country)
- List of age readers and maturity stagers expertise
- Propose a new event
- Manage current events
- List of events
- Verify if a sample file is according to the format
- Creates a new token to work with the web services and the SmartDots software
- Logout

ICES login credentials required to manage events and create reports (country coordinator role)

Reporting module is in continuous development



DTU Aqua translated the traditional analysis into an R script

- Output in .docx format (and .csv/.jpg)
- No R skills needed!
- Output is very flexible and can be edited in MS word
  - Add text, images etc.
  - Edit Tables, optimize design
  - Remove unwanted parts
  - Cannot edit plots
  - .csv output now also possible
- Paper trail for QA records

An additional summary report for assessment groups

- Reader and sample overview
- Overall levels of agreement (PA) and precision (CV)
- Specific info on each readers level of agreement with modal age and bias
- Age Error Matrix (AEM)
- specific answers to issue list ?

Table 4.1.9: Age error matrix (AEM) for 25. The AEM shows the proportional distribution of age readings for each modal age. Only advanced readers are used for calculating the AEM.

Read age	1	2	3	4	5	6	7	8	10	Total
Modal age										
Age 1	**0,89**	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 2	0,07	**0,93**	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 3	0,00	0,00	**1,00**	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 4	0,00	0,00	0,00	**1,00**	0,00	0,00	0,00	0,00	0,00	1,00
Age 5	0,00	0,00	0,00	0,11	**0,89**	0,00	0,00	0,00	0,00	1,00
Age 6	0,00	0,00	0,00	0,00	0,00	**0,89**	0,11	0,00	0,00	1,00
Age 7	0,00	0,00	0,00	0,00	0,00	0,00	**1,00**	0,00	0,00	1,00
Age 8	0,00	0,00	0,00	0,00	0,00	0,00	0,17	**0,83**	0,00	1,00
Age 10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,33	**0,67**	1,00
Total	0,96	1,04	1,00	1,11	0,89	0,89	1,28	1,17	0,67	

ICES Workshop on use of Ageing and Maturity Staging Error Matrices in Stock Assessment WKAMEMSA

WKAMEMSA

Developing and promoting new approaches to incorporate the uncertainty in age and maturity in stock assessment and scientific advice.

27-29 September 2021

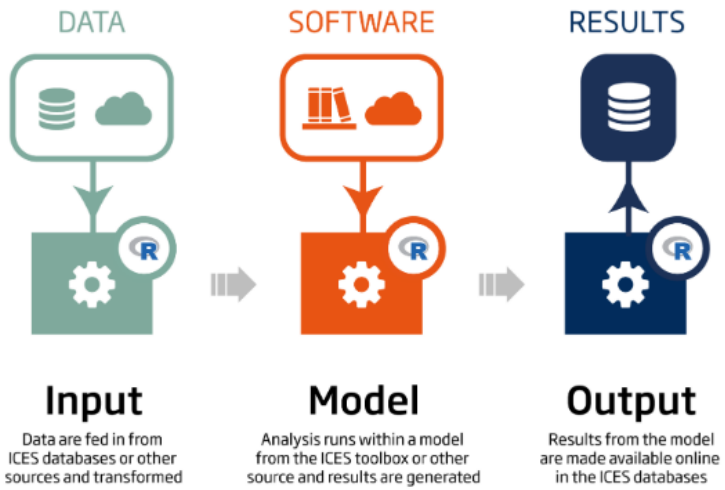
Numerous EG's requesting age error data (AEM's or raw data)

Aim: develop and promote new approaches to incorporate uncertaintity in age/maturity in stock assessment and advice

Members: age and maturity coordinators, model developers, stock assessors and statisticians

Format:

- Literature summary on age reading error integration (…maturity)
- Discussion on guidelines for exchanges and workshops
- Discussion on the SmartDots report
- Presentations of models: Stock Synthesis (SS), State-space Assessment Model (SAM) and Gadget 3
- Presentation of TAF (Transparent Assessment Framework)



TAF The open framework enables anyone to easily find, reference, download, and run the assessment from any stage in the process leading to the published ICES advice

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27-29 September 2021

Suggested improvements to the exchange set-up:

- More **communication** needed between calibration exercise coordinators and stock assessors
- Information to obtain **BEFORE** an exchange/workshop
  - what data is used in the stock assessment (SA) model: areas samples, seasons (especially if survey data is used), what is the age+ group, months used for building maturity ogive, only mature-immature is important
- Report back to SA **AFTER** exchange/workshop
  - SmartDots summary report
  - Join the SA EG's and present the results

Smartdots report is suitable but having easy access to the raw data is necessary

ICES Workshop on Workshop on use of Ageing and Maturity Staging Error Matrices in Stock Assessment WKAMEMSA

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Developing and promoting new approaches to incorporate the uncertainty in age and maturity in stock assessment and scientific advice.

27-29 September 2021

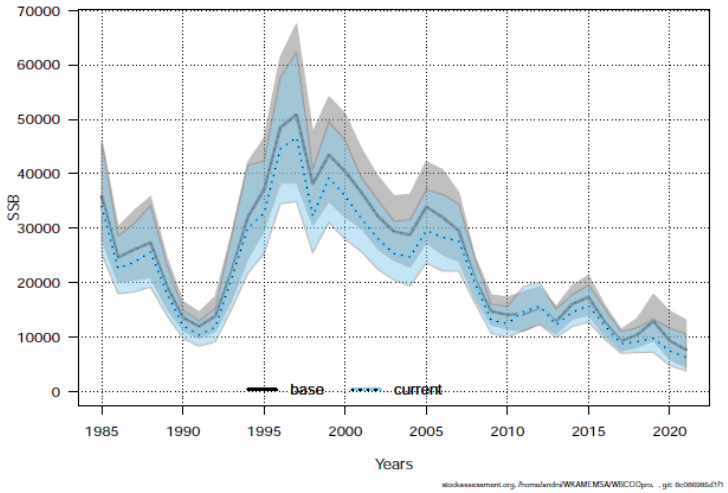
Recommended approach:

– SS3, SAM and gadget 3 are able (or nearly able) to use raw data from exchange events to model an AEM and MSEM (use within the model)

Alternative approach:

– the AEM can be modelled externally and provided to the assessment model

– the AEM can be calculated empirically (assuming modal age as true age), and be used in the models instead of estimating them



Important points:

- Stratification of samples
- Participation of advanced readers/stagers
- Seasonal variation in age reading errors (v.imp. if survey indexes are used)
- AQ scores - can this information be used to model the errors?
- Need for regular calibration exercices to check if an AEM is not changing
- Importance of reference collections to support this

Case studies underway: whb.27.1-91214, mac.27.nea, her.27.1-24a514a, reb.27.1-2, reg.27.1-2, pil.27.8c9a

Multimodal age approach (cooperation with WGBIOP)

- Multimodality
  - Wrong perception of modal age for a fish, always the lowest value
  - Bias and percentage of agreement for some readers is underestimated while overestimated for others
  - Alternatives to define the “modal age”
  - Considering the experience of the age reader: “weighted mode”
- New approach
  - Traditional mode – equal weight
  - Linear weighted mode
  - Negative exponential weighted mode

- Additions to the age reader database required
- Currently in testing phase

Working Group on SmartDots Governance

Count and percentage of multimodality by event in 2019

EventID	event	range_ages	Nreaders	Experienced	Nsamples	Nmultimodal_tradit	Perc_multi_trad
102	PRE-WKARMAC2 Exercise	0 to 14	20	8	135	9	6.7
104	Black scabbardfish 2018	2 to 12	11	0	50	14	28
108	Greater argentine 2018	0 to 18	12	1	50	1	2
109	Tusk 2018	5 to 18	12	2	50	10	20
110	Blackspot seabream 2018	1 to 12	12	0	50	20	40
111	Dab age reading	1 to 12	3	1	79	20	3
144	WKARMAC2 calibration exercise	0 to 13	22	14	143	12	
157	2018 Sole ICES SD 21 & 22	0 to 16	2	1	545		
160	Megrim 6a and 4a	0 to 25	13	8	179		
195	2018 North Sea Sandeel	0 to 6	2	2			32.6
196	workshop 2018 T trachurus	0 to 15	9	5			8.2
197	WKARHOM3 2018 T mediterraneus	0 to 11	3			13	27.7
200	brill 2019 7D 4B 4C	0 to 9				16	12.9
201	cod benchmark 2019	0 t			49	17	34.7
211	Sardine Small Exchange				139	4	2.9
217	STREAM_exchange			3	386	94	24.4
225	SUDOANG//WKAREA 2019		18	0	59	6	10.2
231	Lophius piscatorius 2019	to 12	4	0	212	77	36.3
49	2018 North Sea and 3a Herring Age Re	0 to 6	7	1	38	15	39.5
63	Saithe WKARPV test	0 to 19	4	1	43	10	23.3
64	Test annotation line	0 to 15	2	0	3	2	66.7
65	Smartdot test	4 to 19	2	2	15	8	53.3
72	Sand	0 to 2	1	1	8	1	12.5
74	201	ge Reading Exchange - Whole and Broken	0 to 4	8	7	106	3	2.8
77	2018	ay Pout Age Reading Exchange - Sectioned	0 to 3	5	3	96	0	0
81	Ancho	nange 2018	0 to 5	25	17	160	4	2.5
82	IOS Demo Sandeel	0 to 2	1	0	2	0	0
86	Trac Med 2018	0 to 17	11	3	79	18	22.8
87	Trac trac 2018	0 to 22	14	3	161	20	12.4
94	Plaice age training	0 to 15	2	2	284	25	8.8
95	trachurus pict 2018	0 to 6	11	2	48	2	4.2

Average percentage multimodality: 18.9%

https://smartdots.ices.dk/manage/ListAgeReadersExpertise

2022 Report/updates/bug fixes

- Multimodal age approach
- Web Interface updates to coincide with new icthyoplankton and maturity modules
- New script for maturity staging calibration events
- Plot axes
- AEM format
- Inter-reader bias tests
- Zip folder with all the output tables in .csv format

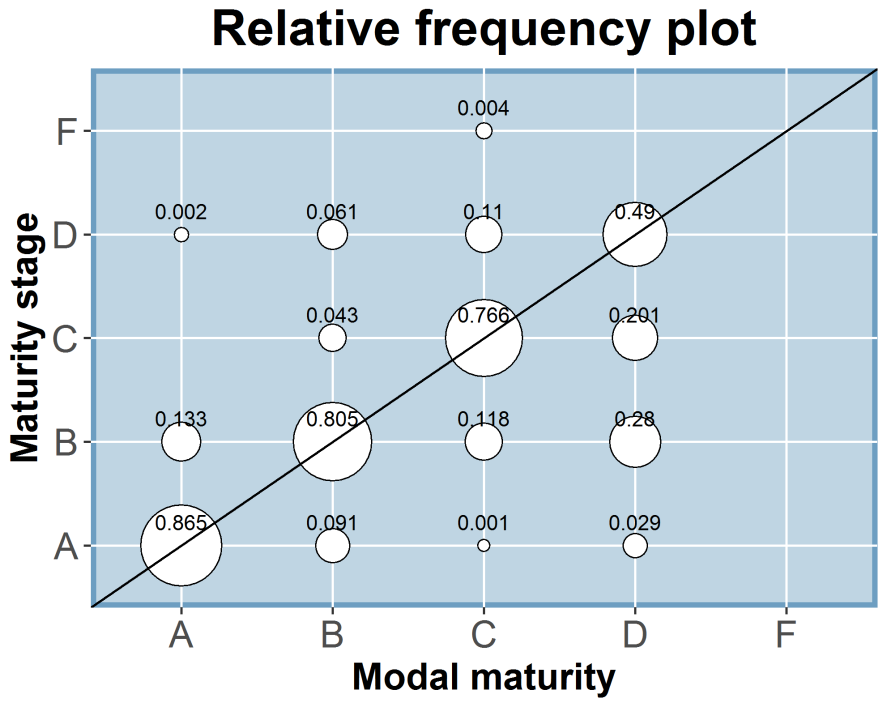


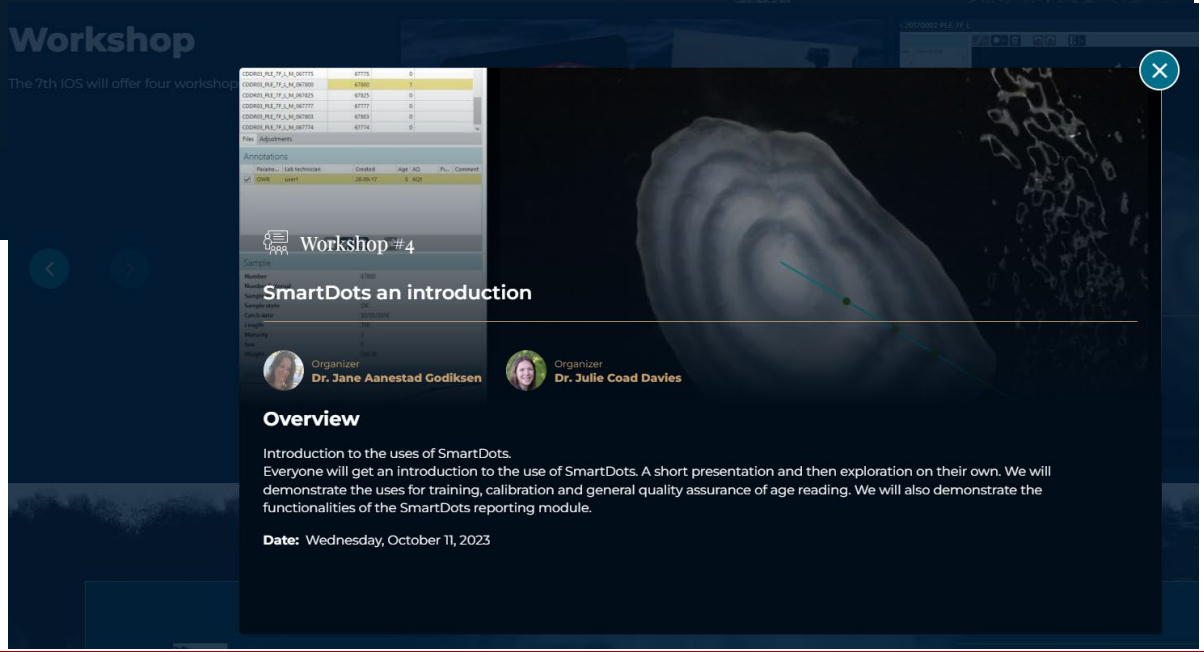
Figure X: Maturity staging bias plot by modal maturity stage for all stagers: presents the frequency per modal maturity and maturity stage for all the stagers together

Aquadots – DTU Aqua's otolith management system

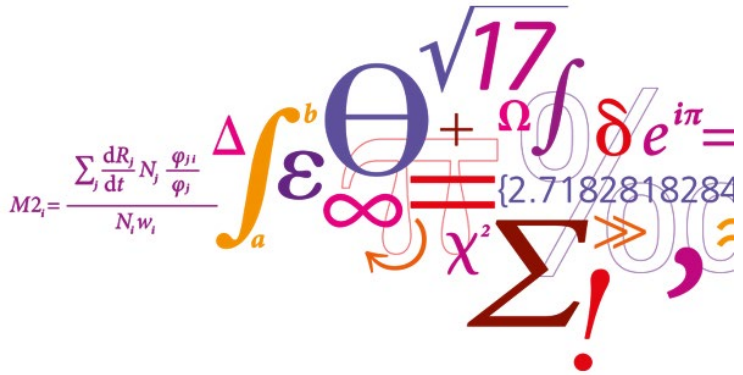
- Developed by the company who built our national database (Fiskeline)
  - Integration into Fiskeline from the start
  - UI matches that which they are familiar with using
  - SmartDots Source code available on github
  - Copy of the database from ICES
  - Support available from ILVO and ICES

  - Recent update a success
    - Same SmartDots software for national and international events

- Reporting for our QA system
  - 2 reader comparison
  - Age_data_check



Demonstration of a Reference Set Module



Thanks for your attention!

DTU Aqua
National Institute of Aquatic Resources