

EU request on dissemination of ICES advice beyond pdf files

Service summary

This technical service is designed to provide options for discussion with DGMARE about future online, interactive, and data-linked approaches to communicating ICES advice. The main focus is advice on fishing opportunities, which is set in the broader context of generic ICES advice and special requests. A new web map service is documented that will enable the European Atlas of the Seas to interact with ICES databases. Four examples are provided of online interactive webpages displaying fishing opportunities advice, and existing online visualization approaches and expectations from recipients of ICES advice are reviewed. Readers of this technical service will need web access to view the products.

Request

In order to ensure the complementarity and compatibility of this new visualization tool with already existing or under development tools such as EMODNET, FishHub, JRC dissemination tool etc. ICES should consult the MARE and the other relevant Commission services for the conceptualisation and specification of the new tool at the beginning of the project.

ICES is requested to make a web-based visualization of advisory products, potentially in an interactive map-format. The outcome must link all ICES advice products providing a combined entrance to advice. The tool should include:

- *Options for creation of interpretable figures/plots placing the advice into context of e.g. stock dynamics of a given stock, guild, fishery*
- *Enable a combination of advice products for a specified entity, e.g. relating a single-stock advice to the ecosystem overview or mixed fishery advice*
- *Options for identification and extraction of the data products behind an advice product (e.g. via INSPIRE standard metadata: <http://qis.ices.dk/qeonetwork/srv/eng/catalog/search#/home>)*

Elaboration on the service

Consultation with recipients of ICES advice

ICES consulted the following recipients of advice about their expectations for the online provision of advice: EU DG MARE, DG Environment, NEAFC, NASCO, OSPAR, HELCOM, and Norway. The consultations took place through arranged telephone calls.

Most recipients of advice had similar expectations:

- Advice should be reached via a direct link from the ICES front web page;
- A map interface could be a clear gateway to the advice. The map should have the possibility to sort the advice in different ways, e.g. by (1) ecoregions, (2) species and/stock, (3) topics, and (4) clients;
- It is important to be able to find the latest advice for each subject. The latest advice on each subject should always be the first option visible through the interface;
- The data and data sources for the advice should be clear, findable, and accessible;
- The search function on the ICES website must be improved.

Review of existing visualization tools

A selection of interactive advice web pages were reviewed to provide insights into approaches and suitable methods (Annex 1). Many offer various routes from the landing page to information pages (e.g. via subject and map interfaces). The dominant tools used were tableau and R shiny apps (<https://www.tableau.com/> and <https://shiny.rstudio.com/>), supported by GIS tools such as ArcGIS and Geoserver.

A similar review of visualization tools developed by EU framework and H2020 projects concluded that very few tools had been developed that linked directly to the original data sources and provided interaction between viewer and underlying

data. Various projects created decision support tools and others produced maps, but none of them were considered transferable into the ICES context. The H2020 project BlueBRIDGE is due to release a Global Record of Stocks and Fisheries (<http://www.bluebridge-vres.eu/grsf-vre>), but this is not yet active.

EU INSPIRE Directive

The INSPIRE Directive aims to create a European Union spatial data infrastructure for the purposes of EU environmental policies and policies or activities which may have an impact on the environment. At present, fisheries and stock assessment information are not well considered in the preparation for the Directive. Thus, to progress preparation, ICES was requested to prepare the stock assessment data to make it comply with the INSPIRE data model. ICES worked with DGMARE to submit an "INSPIRE data model use case: Fisheries" (Annex 2). The outcome of this application is still pending. Further discussions are required and until they are resolved, ICES will focus on an Open Geographic Consortium (OGC) map view service that is nominally INSPIRE compliant and therefore can act as a recognised standard for the output of advice.

Entry to ICES advice

There needs to be a range of mechanisms by which interested web users and researchers can find, explore, and download advice from ICES. A map-only approach expects some degree of understanding from the user. ICES therefore suggests that there are a number of approaches to finding ICES advice online.

As suggested by the surveys of recipients, a direct link to the most recent advice has been requested. Furthermore, a user-friendly access point is needed, such as those found in WISE-Marine, OSPAR intermediate assessment, or HELCOM HOLAS II. This suggests that a formal access point, a map approach, and a visual narrative approach are all needed. In addition, ICES has created a web map service to feed into the European Atlas of the Seas (see below), which will open the advice to a new audience and add another dimension to accessibility.

Maintaining a public history of advice

ICES will need to archive the advice. Each piece of advice and extraction from a database will be accompanied by a DOI (digital object identifier) and associated metadata. At the end of every year ICES will publish the year's advice in a new ICES Advice Publication Series. This will preserve the record of advice beyond the elements stored in ICES databases and web pages.

Web map service (wms) compatible with European Atlas of the Seas

A consultation with DGMARE led to an additional product being added to the request; a process to initiate access to ICES stock assessment information through the European Atlas of the Seas. The combined information from the stock assessment and from stock information databases are now available through a web map service. This will allow the European Atlas of the Seas to show ICES fish stock assessment products. The wms is described here: http://map.ices.dk/geoserver/ices_eg/wms?service=WMS&version=2.0.0&request=GetCapabilities.

The layer for the stock assessments is: ices_eg: VISA_StocksEcoregions_3857_simple_10km.

This service has been utilized via the ICES spatial facility. The map visualization is intended as a demonstration of how the information could be shown, with the advantage of the web map service being that the consumer of the service (the European Atlas of the Seas) can style and implement features to their requirements. Through this layer it is also possible to obtain the results of previous year's advice. The provision of the wms is a first step towards visualizing and linking ICES stock assessments to the European Atlas of the Seas, recognising that further iterative development of the service and visualization is required.

Examples of potential interactive advice on fishing opportunities for four stocks

As an example of a preliminary approach to providing ICES advice online, four example stock sheets with downloadable data sources and interactive graphical features have been published (examples of hake, blue ling, herring, and *Nephrops* stocks). These should work in any web browser. The data are drawn directly from the stock assessment graphs database

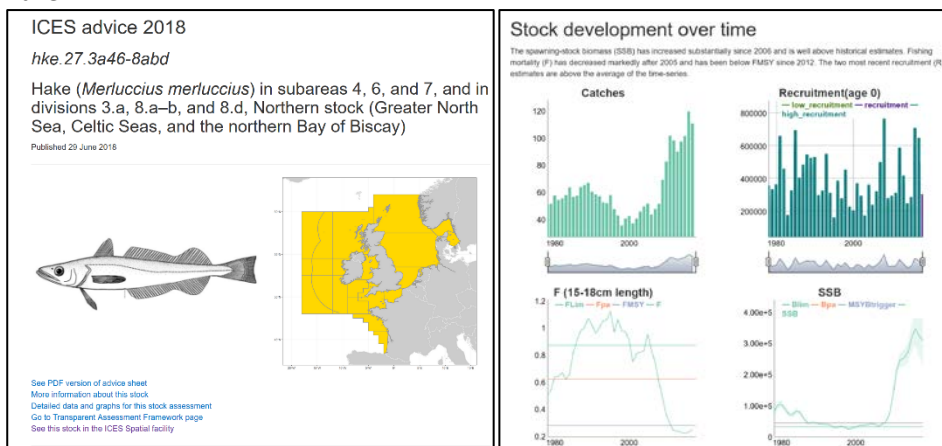
(SAG) and from the stock information database (SID). The potential exists to also link to the stock assessment input data and model code through the transparent assessment framework (taf.ices.dk). These four sheets are examples to initiate a discussion with DGMARE and other recipients of advice, and to encourage debate within the ICES network.

The advantages of this approach in terms of accessibility are:

- all content is in html, and therefore easier to read and search on web devices;
- improved navigation around the document sections through the side menu;
- links to further information on the stock in ICES databases (latest advice, SID, SAG, TAF);
- all tables are downloadable as comma-separated variable files (csv);
- graphs from SAG are active and allow identification of single points and their value;
- the stock status table is presented in a simplified way, compared to that in the Advice sheets. Only the used options (maximum sustainable yield, precautionary approach, or management plan) are shown.

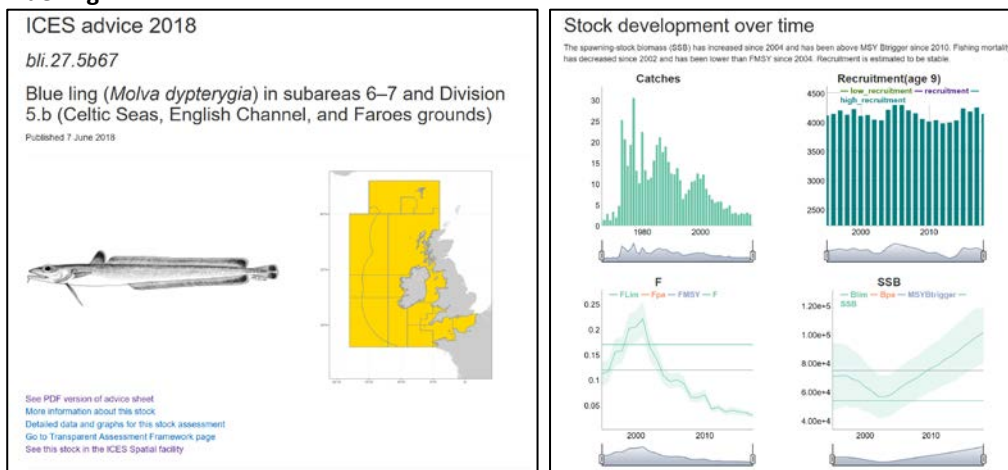
The four web-based examples of stock advice on fishing opportunities are shown below.

Hake



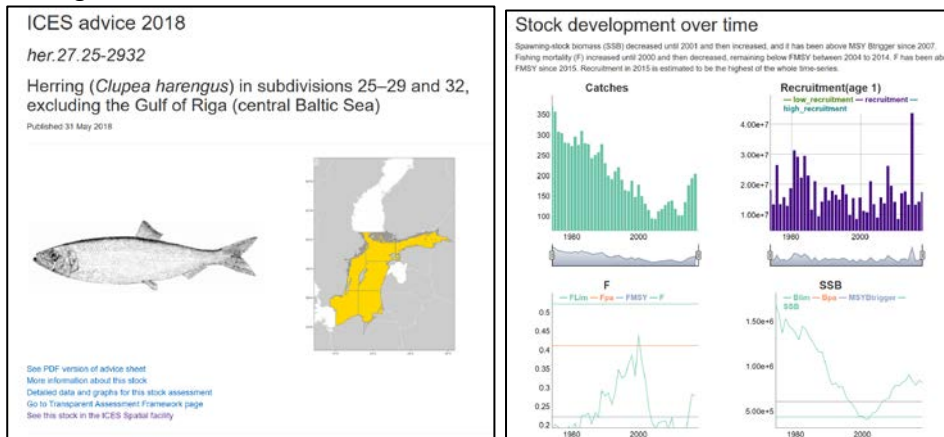
https://ices-tools-dev.github.io/VISA_tool/hke.27.3a46-8abd.html

Blue ling



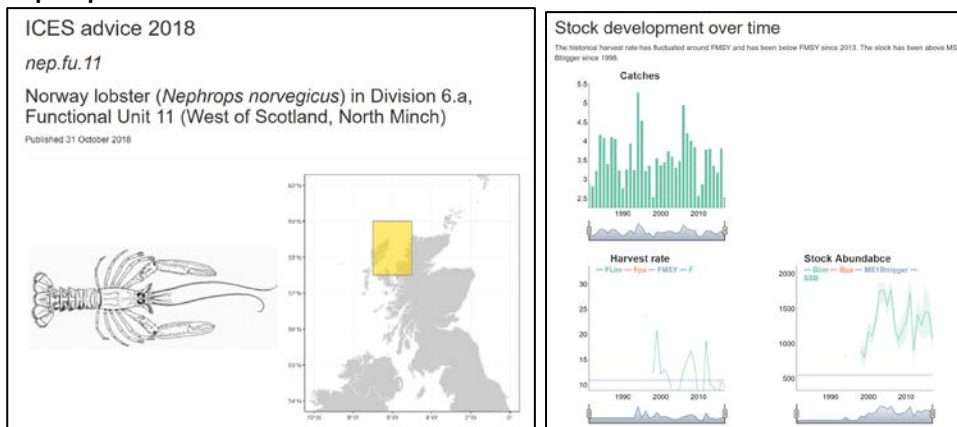
https://ices-tools-dev.github.io/VISA_tool/bli.27.5b67.html

Herring



https://ices-tools-dev.github.io/VISA_tool/her.27.25-2932.html

Nephrops



https://ices-tools-dev.github.io/VISA_tool/nep.fu.11.html

Basis for the technical service

Background to the request

The provision of advice would need to be done in a salient and understandable way. Managers and Stakeholders should have ready access to the science behind the advice, the interrelation with other advice products. Resources have already been invested to ensure that the quantitative information and qualitative knowledge that forms the main body of advice is available via databases and online tools, but at present this information is channelled into a static pdf document.

Now we see the need to bring together the different aspects of fisheries advice (biological, technological, environmental etc.) in a dynamic interface to improve the communication of advice products to the Commission, stakeholders and the general public. Also the delivery of the results of management evaluations (i.e. the likely consequences of fishing options on stock development) needs to be streamlined and interpretable.

Moreover, EU countries are obliged to implement the INSPIRE Directive, which is bound to fisheries assessment outcomes via the Descriptor 3 of the Marine Strategy Directive (MSFD). In many cases, EU member countries will rely on regional assessments of fisheries to answer their MSFD reporting obligation, which will infer that ICES will need to provide advice products according to INSPIRE implementing rules. Given that ICES is the initial provider of this information, and co-producing products with client and stakeholder input, ICES is best positioned to create such a visualisation and interpretation tool for fisheries advice. ICES will use the experience developed through EU projects such as MYFISH and MAREFRAME in creating visualisation tool for fisheries advice.

Additional information on the web map service

Technical specifications for the web map service

The data used for the wms product have been joined into a single layer from several databases hosted by ICES (SID, SAG, ICES Vocab, WoRMS register). This layer has been published on a Geoserver in the standards (WMS, WFS).

WMS capabilities:

http://map.ices.dk/geoserver/ices_eg/wms?service=WMS&version=1.1.0&request=GetCapabilities.

WFS capabilities:

http://map.ices.dk/geoserver/ices_eg/ows?service=WFS&version=1.1.0&request=GetCapabilities.

Layer name: ices_eg: VISA_StocksEcoregions_3857_simple_10km

Field descriptions:

AssessmentKey	Unique ID for an assessment. Can be used to link to the assessment data and graphs, e.g. http://standardgraphs.ices.dk/ViewCharts.aspx?key=9757
StockCode	Unique code for a stock, e.g. cod.27.21
StockKey	Unique id for a stock. Can be used to link to the ICES vocabulary, e.g. https://vocab.ices.dk/?codeID=169086
Status	Status can be either published or unpublished
AssessmentYear	Year the assessment took place
SpeciesName	Scientific name of species
StockDescription	Description of the stock
EcoRegions	The list of ecoregions the stock extends to in a short format, concatenated with a ~ symbol
EcoRegionsLongName	The list of ecoregions the stock extends to in a long format, concatenated with a comma symbol
shape	Geometry of the above ecoregions
FishingPressureStatus	Status of the fishing pressure. Can be either Below, Appropriate, or Above*
StockSizeStatus	Status of the stock size. Can be either Below or Above*
LastestStockSizeYear	The year the stock size assessment is referring to
LastestFishingPressureYear	The year the fishing pressure assessment is referring to
LastestStockSizeStatus	Code for the icon of the status*
LastestFishingPressureStatus	Code for the icon of the status*
FishingPressureLabel	Fishing pressure label. Most of the time it is FMSY*
StockSizeLimitLabel	Stock size label. Most of the time it is MSYB*
LineDescription	Label that most of the time refers to "maximum sustainable yield"
Common_name	Common name of the species (WoRMS)
WormsID	ID of the species in the WoRMS register
SID_ID	Unique ID of the stock in ICES stock database. Can be used to link to ICES stock database, e.g. http://sid.ices.dk/ViewStock.aspx?key=1446

*For more information refer to:

http://ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/Introduction_to_advice_2018.pdf#page=10.

Additional information on online ICES stock advice sheets

The single-stock advice web visualizations were created through R markdown documents (Rmd). The advantages of this method are:

- Rmd has the potential to become a model document through which as many single-stock web pages as required may be developed. It allows users to connect with the various data sources, but also to create content, tables, or graphs within this same document.
- R is a more user-friendly tool than others, so it could be used and maintained by a larger community. It is a flexible tool, with continuous updates and compatibility with other tools.

- The information presented is exactly the same as in the advice sheets.

Data preparation

Prior to the development of the web pages through R mark down, the data were retrieved from different sources and following different strategies:

- The majority of the text and tables come from the existing advice sheet word documents. A script to extract the information in this sheets is used. The more homogeneous the advice sheets are, the easier the extraction of the information. With time, it is hoped that this process will develop into a knowledge management framework.
- The active graphs and the assessment summary are created through enquiry to the stock assessment database (SAG).
- The catch scenarios are the most challenging stage of production due to their heterogeneity. An initial extraction can be automated, but as these come only from the advice sheet. A solution to this would be to include the information on this tables in some of the already existing ICES databases.

Draft versions of all code used to gather data, clean up files, and create html are available here:

https://github.com/ices-tools-dev/VISA_tool

Annex 1 Examples of web application to view and query marine data and advice

Organization, country	Websites	Description	Use	Tools used
STECF, EU	https://stecf.jrc.ec.europa.eu/dd/me dbs/ram	Interactive graphs for Mediterranean fish stocks	Easy to use and flexible, allows creation of a variety of dashboards. Also used by EEA for data dissemination. Not open-source software.	https://www.tableau.com/
STECF, EU	https://stecf.jrc.ec.europa.eu/dd/eff ort/graphs-quarter	Query-able and downloadable data	Easy to use and flexible, allows creation of a variety of dashboards. Also used by EEA for data dissemination. Not open-source software.	https://www.tableau.com/
Marine Institute, Ireland	https://shiny.marine.ie/speciesdash/	Distributions and biology of fish from surveys across time	Downloadable and visually simple with sliders.	https://shiny.rstudio.com/ – functions best in Google Chrome browser
EU WISE MARINE	https://water.europa.eu/marine	Information and resources on the state of the marine ecosystem	Comprehensive and simple to use. Links to signals and indicators through maps and subjects. Links through to many information providers. Data not downloadable.	https://www.tableau.com/ – with support from ArcGIS and Geoserver
Marine Institute, Ireland	https://shiny.marine.ie/stockbook/	Stock assessments for current year	Not downloadable, but comprehensive provision of the most recent advice.	https://shiny.rstudio.com/
Thünen Institute, Germany	https://fischbestaende.thuenen.de/	Descriptions of fish stocks and most recent advice	Entry via fish species. Not interactive and no links to underlying data.	
RAM legacy, International	http://ramlegacy.org/gapminder-visualizations/	Global inventory of stock assessments	Free data download in xls or access format and visualization of a time-series tool. Regionalization available.	https://www.gapminder.org/ – but uses flash, hence security concerns
NOAA, USA	https://www.st.nmfs.noaa.gov/sisPortal/sisPortalMain.jsp	Inventory of USA stock assessments	Welcoming introductory pages, but fish description pages are not linked through to stock assessment pages. Data downloadable.	Not clear which tools are used, not fully functional in all browsers
ICES, International	https://taf.ices.dk	Transparent assessment framework	Takes interested users of stock assessments to the data sources and code to run the assessments.	https://github.com/ – with AspNet Core application
FAO, international	http://firms.fao.org/firms/en	Map viewer of inventory of fish stocks	Map interface with links to regional stocks, including status for each fish stock. Attractive and simple, but route to download data is subtle (difficult to find).	

Annex 2 INSPIRE data model use case: Fisheries

This is the use case submitted by ICES and DGMARE to JRC INSPIRE for consideration.

Country/Issue number:	Affected article/annex: Annex 3	Theme(s): Species Distribution(SD)/ Statistical Units(SU)
Subject: How to fit fisheries stock status outputs into INSPIRE data models for MSFD Descriptor 3		
<p>Observations/problem description:</p> <p>Fisheries stock status provides key indicators of good environmental status (GES) in the MSFD (D3). A mapping has been made from the official stock status outputs (advice sheets) to the MSFD reporting schema (example and also source). However, to fully utilize this information at the EU Member State level, and to be able to refer to it directly in their reporting obligation to the Commission, EU Member States will require that the provider of the stock status (ICES) make download services that comply with INSPIRE.</p>		
<p>Proposed legislative change(s):</p>		
<p>Rationale for change(s): (including links to further references or discussions, e.g. on the Thematic Clusters)</p> <p>The relevant data model from INSPIRE is “Species Distribution” (SD). However, although it seems possible to relate the basic information (stock area would equate to a geometry, etc.), a number of specific elements of a stock status are missing from the SD model, i.e. “assessment year” is not the same as “collected from”, etc. It is not clear if these elements can be added to the SD model, or whether they exist already in other Annex 3 data models. And if so, guidance would be needed on how to implement this in the correct uniform way.</p>		
<p>Expected impacts (including benefits):</p> <p>Enabling a mapping of fish stock status to INSPIRE data model(s) will facilitate directly the obligations of reporting by EU Member States to the Commission on MSFD, while also bringing a more transparent and machine-readable access to stock assessment outputs for all end users. This would also be the first example of a fisheries implemented in INSPIRE opening the opportunities to other future fisheries-related datasets.</p>		