Data and Information Services

1 Summary

Awareness of, and attention to, good data management have proliferated across the ICES community in recent years. Both SCICOM and ACOM have played an important role in delivering buy-in across the expert groups and committees. The data management handbook for expert groups, and the mantra of FAIR that is now embedded in advice and science presentations are positive examples of this.

Data management cannot afford to stay still, and the work of DIG with the Data Centre to progress data governance, accreditation and to continuously review our policies, licencing and services around data are showing that we still have a great deal of work to do.

Progress on data accreditation and data governance are important milestones for Council to note, as is the overall effort on quality assurance that is being tasked across ACOM, SCICOM and Data.

2 Data Centre Accreditation

The issue of accreditation, a process where the overall ability of an institute is assessed objectively and independently against a predefined checklist of criteria, was highlighted in Bureau Doc 2125[1] and discussed in Bureau in February in relation to a move to an overall quality assurance framework for ICES. This was followed up with a combined (ACOM, SCICOM, Data) document to ACOM "Towards a Quality Assurance Framework for ICES Advice"[2]. From this, there were clear implementation tasks to move ICES, through its Data Management systems, towards an accreditation and to ensure that all advice products are based on data that adhere to the FAIR principals.

The Data Centre prepared a briefing on accreditation (see Annex 1: ICES data centre accreditation explained) to aid the DIG discussion on which accreditation route to take in the first instance. DIG met in May 2019 and the decision on accreditation was as follows:

> *It should also be noted that DIG identified ICES Data Management accreditation as a medium potential to disrupt in the tracker now used for following changes that may impact ICES data management. This means that there are some challenges in terms of staff resources required to meet this task, as well as opportunities in gaining recognition and increasing confidence in ICES data and advice products.*

1 http://community.ices.dk/Committees/Bureau/2019/Bureau_meeting_256_Feb/Meeting_docs/2019-02_Bur_Doc_2125_Data.pdf

2 http://community.ices.dk/Committees/Bureau/2019/Bureau_meeting_257_June/Meeting_docs/2019-06_Bur_Doc_2134_Quality_Assurance_Advice.pdf

Overall there was agreement that either of the accreditation schemes would serve ICES well in preparing the evidence for processes. DIG also observed that the accreditation process itself focusses on the existing processes, and does not in itself guarantee best data management practises. But it initiates a programme of work that will identify areas in need of improvement and areas of strength – much like what has been initiated with the governance work. Going through a formal process provides clarity and a need to deliver – but it is equally important to use the information developed in the accreditation process to develop an improvement programme.

The final DIG decision is to start accreditation with the Core Trust Seal (CTS) process.

2.1 Next steps and challenges

In the initial accreditation application, ICES will restrict the scope to datasets and data products currently managed by the ICES Data Centre. The Data Centre is now starting to analyse in detail the requirements of the CTS and determine where it will need to improve or collate information in regards to answering the requirements. In short, to gain accreditation an institute would need to score 3 or above on each of the 16 requirements. Our current self-assessment (see Table 1 Evaluation of preparedness for accreditation) highlights that we have potentially 3 requirements where we will need to invest effort in bringing up-to-standard. The Data Centre is aware that not all data flows are at this standard, and much of the work now will be focussed on harmonizing documentation, workflows and references to ensure that we have everything that ICES Data Centre manage in a consistent form (for an example see Annex 2 – Data delivery deadlines). Furthermore, the intention of the CTS is to have a continuous improvement in fulfilling the criteria, which requires that we think of an overall plan of how we will improve the rating beyond the initial 3 year accreditation.

Based on this, we expect to be in a position to apply for accreditation (**for datasets and data products currently managed within the Data Centre)** in 2020.

The reason for highlighting that we will first only seek accreditation for data and data products currently managed within the ICES data centre is that the greatest challenge, and what has been highlighted by the document "Towards a Quality Assurance Framework for ICES Advice", lies in bringing all data and data products used in ICES advice within scope. For example, there are survey indices used in assessment that are not part of DATRAS or Acoustic, or datasets that do not formally receive an accession number in the ICES data ingestion system. Cataloguing, evaluating and documenting these will be a challenge and require commitment from ACOM, the expert groups and the Secretariat to achieve this. We would therefore have some time (up to 3 years) to work on this before we are due to renew the accreditation and bring these into scope.

Table 1 Current overall self-assessment of preparedness for accreditation against 16 criteria

Organizational Infrastructure			Compliance
R1.	Mission/Scope	The repository has an explicit mission to provide access to and preserve data in its domain.	4 (Implemented)
R2.	Licenses	The repository maintains all applicable licenses covering data access and use and monitors compliance.	2 (Plans to implement)
R3.	Continuity of access	The repository has a continuity plan to ensure ongoing access to and preservation of its holdings.	4 (Implemented)
R4.	Confidentiality, Ethics	The repository ensures, to the extent possible, that data are created, curated, accessed, and used in compliance with disciplinary and ethical norms.	3 (In implementation phase)
R5.	Organizational infrastructure	The repository has adequate funding and sufficient numbers of qualified staff managed through a clear system of governance to effectively carry out the mission.	4 (Implemented)
R6.	Expert guidance	The repository adopts mechanism(s) to secure ongoing expert guidance and feedback (either inhouse, or external, including scientific guidance, if relevant).	4 (Implemented)
Digital Object Management			
R7.	Data integrity and authenticity	The repository guarantees the integrity and authenticity of the data.	4 (Implemented)
R8.	Appraisal	The repository accepts data and metadata based on defined criteria to ensure relevance and understandability for data users.	4 (Implemented)
R9.	Documented storage procedures	The repository applies documented processes and procedures in managing archival storage of the data.	3 (In implementation phase)
R10.	Preservation plan	The repository assumes responsibility for long-term preservation and manages this function in a planned and documented way.	4 (Implemented)
R11.	Data quality	The repository has appropriate expertise to address technical data and metadata quality and ensures that sufficient information is available for end users to make quality-related evaluations.	4 (Implemented)
R12.	Workflows	Archiving takes place according to defined workflows from ingest to dissemination.	4 (Implemented)
R13.	Data discovery and identification	The repository enables users to discover the data and refer to them in a persistent way through proper citation.	4 (Implemented)
R14.	Data reuse	The repository enables reuse of the data over time, ensuring that appropriate metadata are available to support the understanding and use of the data.	4 (Implemented)
Technology			
R15.	Technical infrastructure	The repository functions on well-supported operating systems and other core infrastructural software and is using hardware and software technologies appropriate to the services it provides to its Designated Community.	4 (Implemented)
R16.	Security	The technical infrastructure of the repository provides for protection of the facility and its data, products, services, and users.	4 (Implemented)

3 Data Governance

The ACOM document "Towards a Quality Assurance Framework for ICES Advice" also calls for the implementation of a comprehensive ICES quality management system for advice including implementing RDBES, TAF, etc. The ICES Data Centre and DIG, together with the relevant expert groups have been working on establishing governance groups for each of the main systems that support data flowing into/out of the advisory process. These groups are/will work to a standard set of ToR's which encompass:

- Establish a governance framework setting out a forward looking plan, including objectives of *[Data Workflow]*, responsibilities, processes and resources.
- Provide a platform for user feedback to *[Data Workflow]*. Appropriate actions to be taken with assigned responsibilities and resource requirements will be listed and prioritised
- Oversee and advise on the interpretation and prioritisation of recommendations for *[Data Workflow]*
- Oversee development of user guidance and training for *[Data Workflow]*

To date, governance has been established for:

- RDB/RDBES (SC-RDB)
- DATRAS (WGDG)
- SmartDots (WGSMART)

It is planned by the end of 2019, governance will also be in place for:

- Acoustic portal
- TAF
- VMS/AIS spatial fisheries data[3]

The draft resolutions for these groups, as well as reports from the existing governance groups were presented at DIG in May. Further to this, DIG is supporting efforts to evaluate these systems against data management principles to highlight gaps, which will in turn feed into the accreditation and governance processes. In their 2020 work programme, DIG have committed to evaluate Spatial Fisheries Data workflow, Marine Environment Data flow (DOME), and the Vulnerable Marine Ecosystem portal (VME).

Each governance evaluation will follow a similar structure:

1. Initial evaluation, following the categories and questions
2. Reviewer scoring and identifying broad improvement areas
3. Share initial findings with developers and groups governing the data structure to reach consensus on the state/scoring and identified improvements
4. Governance structure identifies actions to prioritise improvements and takes forward the improvement programme
5. DIG revisits governance evaluation, specifically to see how categories/questions with identified improvements have been progressed (1-3 years later)

3 WGSFD/Secretariat are currently responsible for this but have taken the decision to setup a dedicated governance group for these data types

3.1 Best practice for Data Management Handbook

DIG and ICES Data Centre developed a user handbook on Best practice for Data Management (doi 10.17895/ices.pub.4889) in preparation for the WGCHAIRS meeting in January 2019. The handbook has generally been well received, and is already in use for guidance. For example, the handbook was referenced in the ACOM-SCICOM Data Quality document "Towards a Quality Assurance Framework for ICES Advice". The handbook has also been referenced in various workshops since its release.

DIG will continue to review the handbook to ensure it stays relevant.

3.2 Data policy and licensing

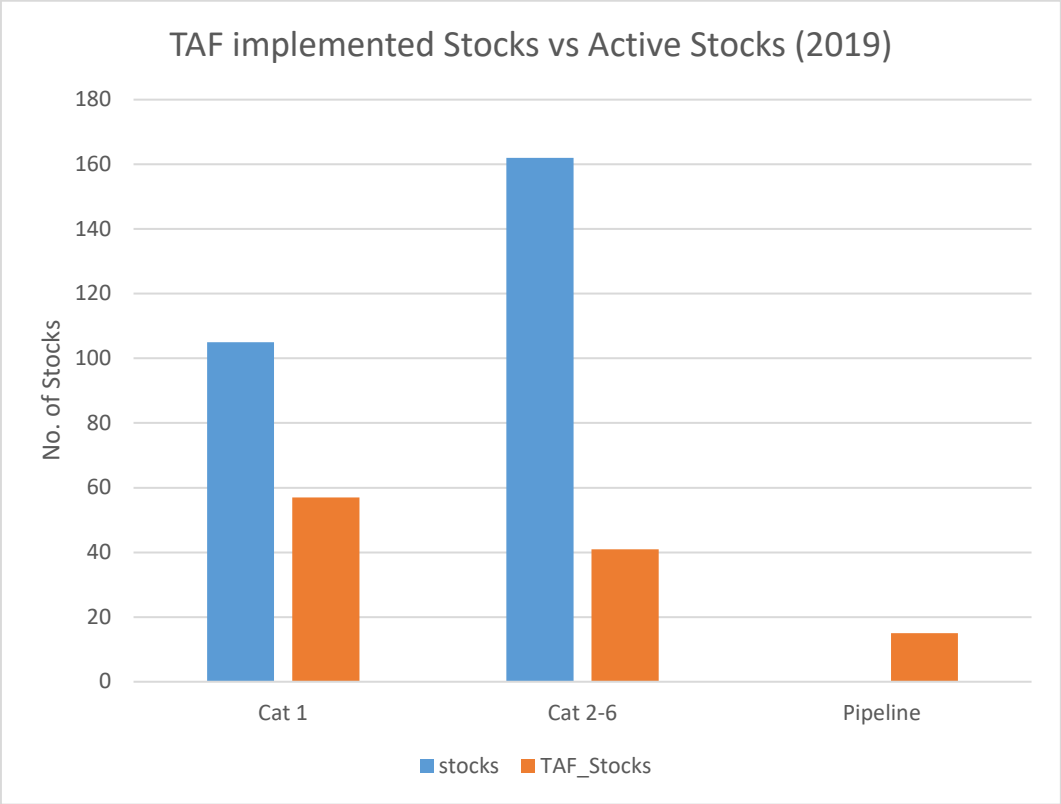
DIG together with the ICES Data Centre routinely performs a review of the ICES Data Policy. This is done to ensure that the data policy reflects current considerations and reflects changes in ways to access or work with data. There are now additional data policies that cover areas where the default open access cannot be provided due to the sensitive or commercial nature of the data being used in certain workflows. These data policies were also reviewed in order to ensure there is alignment and consistency in the use of terminology across the policies.

Looking ahead, a separation of license and data policy will be easier to manage and clearer for data users. At the same time, this will allow ICES to look to align to an externally recognised standard of licencing which will have other advantages i.e. alignment with contracting parties and advice recipients data sharing models. In 2020, based on an overview drawn up by DIG of existing open data licensing models, and an evaluation of their benefits and drawbacks in the ICES context, a proposal for the revision of the ICES Data Policy will be presented to Council. This will also better align with aspects of the ICES Data Centre Accreditation.

4 Transparent Assessment Framework (TAF)

The focus in 2019 has been on ensuring adoption and building competence in the ICES assessment community. Five training workshops have been held, 3 in ICES with online attendees via WebEx, and two regional training workshops covering the Celtic Sea and North Sea regions. Workshops for the Bay of Biscay and Iberian Coast and the Baltic Sea are planned for 2020. The workshops attracted stock assessors and stock assessment data coordinators, with the benefit being that several TAF analyses that document processes involving catch data at a national level and survey indices have started to be developed.

TAF is also being used by some WGs to document quality checking and processing of data received from the fisheries data call. This is an area where a greater focus will be placed as ICES moves into a Quality Assurance Framework.



5 Regional Database and Estimation System (RDBES)

On the 13th September, the new updated version of the RDBES (v1.17) was published. The number of different generic sampling schemes that have been identified for countries has increased from 8 to 13, not including the lower more detailed sampling level. The participants of the WKRDB-EST (estimation workshop) 30th Sep. to 4th Oct. should use the RDBES for their data, all national data uploaders can also have access to the new version of the RDBES. The data relevant for landings and effort data have been specified, and the sample data have been further developed. All documents and information is on a public GitHub site.

With reference to the separate Council document on a proposal for investments of ICES equity, where the RDBES is one of the recipients of this, Council should take note that efforts have been made to gain funding for its development through the European Commission. Previously, proposals have been sought via specific budget lines in the European Maritime and Fisheries Fund (EMFF) which are reserved either for regional capacity building or so called 'study proposals'. This proposal was based on Member States directly allocating money from their share of the EMFF budget to the development of the RDBES. The proposal was tabled by the chair of the SC-RDB to the Regional Coordination Groups (RCG's) of the EU Data Collection Framework. This was positively endorsed and then taken to the meeting of the National Correspondents for agreement in September. The national correspondents were unable to reach agreement on the mechanism for funding, even though they agreed the RDBES was an important tool for their coordination.

6 Activities Dashboard

Table 2: 2019 Dashboard: Inputs and outputs to assessments and products

Activity	Project or System	Source funding	Current Status	Comments
Pre-input to assessment	**SmartDots platform** Otoliths Exchange	Institutes own investment, although WGSMART is exploring funding opportunities via EMFF	On track	http://ices.dk/marine-data/tools/Pages/smartdots.aspx WGSMART (governance) in full operation since Autumn 2018. Web app and documentation delivered under an EU technical service at the end of 2018 https://doi.org/10.17895/ices.pub.4673 Headline stats: - 52 age reading events - 25 countries involved - 264 participants - 800 000 + annotations
Quality assurance of input data to assessment	**DATRAS** fisheries independent data	DG MARE Special request (for 2018)/ Council investment (2017-18)	On track	2 workshops achieved for i) Bay of Biscay, Iberian ii) North and Celtic seas in 2018
Indices for assessment input			On track	Workshop (WKSABI) completed in 2019 to examine methods to develop a swept-area based effort index that can be used across the survey types in DATRAS

Activity	Project or System	Source funding	Current Status	Comments
				Smaller workshop with the OSPAR biodiversity lead in August 2019 to align processes.
Governance of data products			On track	WGDG formally established in 2018 and meeting regularly
Quality assurance of input data to assessment	**Acoustic portal** Fisheries independent data	H2020 AtlantOS project (ends July 2019)/ICES Core funding	Some delay	Some surveys still missing from Norway, although data are starting to be prepared/included, as well as Iberian and Bay of Biscay surveys yet to be included.
Indices for assessment input			On track	Portal live and populated for a number of North East Atlantic and Baltic Surveys including HERAS, PELGAS, BIAS and BASS. http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx Discussions have been ongoing between the REDUS (Norway) project and TAF to bring these into a fully transparent and standard workflow.
Governance of data products				ToR's drafted and discussing with working groups on a suitable chair to lead this work. On track to have a group established in late 2019

Activity	Project or System	Source funding	Current Status	Comments
Raising and estimation of commercial catch data for input to assessment	**Regional Database and Estimation System (RDBES)** Fisheries dependent data	Council Investment (2017-2018)/ DG MARE Special request (for 2018);	Behind schedule	13th September, the new updated version of the RDBES (v1.17) was published. Number of different generic sampling schemes that have been identified for countries has increased from 8 to 13. All documents and information is on a public GitHub site Funding: the national correspondents were unable to reach agreement on the mechanism for funding, even though they agreed the RDBES was an important tool for their coordination
Protected species bycatch estimates	**Bycatch (PETS) database** WGBYC	ICES core/DCF	On track	Bycatch data format and portal (http://bycatch.ices.dk/) fully established. The 2019 data call received data from 21 countries in Europe.
(ICES Area): Various spatial/tabular data products for analysis of fishing effort and impact	**VMS and Logbook** Fisheries dependent data	Various	Potential for data provision issues	This is now established as a core ICES data call, QC process and data flow. Spain has successfully submitted data for the 2019 data call, having sent a test dataset in the 2018 cycle. Russia and Greenland are still non-responsive to the data calls for VMS/Logbook data. The VMS/Logbook conditions of use licence was reviewed by DIG in their 2019 meeting

Activity	Project or System	Source funding	Current Status	Comments
				and was agreed by WGSFD; to avoid confusion with this years cycle the updated licence will be released at the end of 2019.
(NEAFC Area): Various spatial/tabular data products for analysis of fishing impact		NEAFC MoU	On track	Technical issues largely addressed in inter-sessional period between bilateral meetings in 2017 and 2018. ICES would like to explore with NEAFC whether we can further optimise the QC (via scripted checks) as an additional improvement.
Repeatable and documented assessments, quality control of inputs and outputs to assessment	Transparent Assessment Framework (TAF)	Council Equity, until March 2020	On track	TAF officially launched the online web application at the Mediterranean FishForum in December 2018. The side event generated a lot of interest across the international fisheries science community. The focus in 2019 has been on ensuring adoption and building competence in the ICES assessment community. Five training workshops have been held, 3 in ICES with online attendees via WebEx, and two regional training workshops covering the Celtic Sea and North Sea regions. Workshops for the Bay of Biscay and Iberian Coast and the Baltic Sea are planned for 2020. On the ground level: - 57 category 1 stock assessments implemented

Activity	Project or System	Source funding	Current Status	Comments
				- 41 category 2-6 stocks - 15 currently in the pipeline
	Stock Assessment Graphs (Database) SAG	ICES Core/DG MARE Special request	On track	Both systems formed part of the response to the 2018 advice request on moving the outputs of advice beyond PDF documents. In May 2019 the Data Centre met with the European Atlas of the Seas (a DGMARE initiative) to discuss how the interactive services developed can be shown on the EU Map Portal – this is still being explored as simplification is needed for a map based product.
	Stock Information Database	ICES Core	On track	
Repeatable and documented assessments, quality control of inputs and outputs to assessment	Contaminants Assessment Tool	OSPAR, HELCOM and (AMAP)	On track	The OSPAR online tool has been delivered, the HELCOM tool will be finalised by the end of June; both will be available on the ICES and RSC's websites before the summer. AMAP will hosted a workshop at ICES in June, where the AMAP tool will be further discussed.
	Eutrophication Assessment Tool	HELCOM, OSPAR	On track	The HELCOM tool continues to grow and develop, HELCOM are currently looking at funding models for supporting this work. OSPAR have a special request for the further development of the Eutrophication

Activity	Project or System	Source funding	Current Status	Comments
				assessment using the online tool developed at ICES.

7 Annex 1: ICES data centre accreditation explained

7.1 Summary

Data accreditation is not a new discussion topic at ICES. In 2014, the ICES Data Centre and the Data and Information Group (DIG) discussed pursuing data accreditation based on the newly established IODE quality management framework. They concluded at that time, the effort needed to achieve accreditation was too great in relation to the systems and documentation that the ICES Data Centre had in place. There has been increasing interest from stakeholders and clients to ICES to look more systematically at the overall quality assurance to ICES outputs, with data governance and management being a keystone of this. The Head of Data and Information was challenged by ICES Council in 2018 to look into the ICES approach to data governance, and in February 2019 a report[1] was made to Bureau outlining governance aspects in ICES, and also accreditation.

Therefore, having discussed with the Chair of DIG inter-sessionally, the ICES Data Centre will pursue an accreditation.

7.2 Accreditation

The main reasons for seeking data accreditation in the ICES context:

a) Having clear and consistent documentation, processes and guidelines on how ICES manage data,
b) benchmarking the data centre against known criteria (and other data centres) to understand the maturity of the services that the Data Centre provide,
c) reducing errors and uncertainty in the processes of delivering data through the ICES system – a clear link to the overall quality management system that ICES is considering, and
d) funding bodies for research, or even ICES clients, may, in the future, require ICES to have such accreditation in order to bid for, or deliver services.

Furthermore, having data flows properly documented would make the training of new employees less time consuming. Protocols would also facilitate cooperation between co-workers by clearly detailing who are the custodians for each data type.

The ISO 9000 series of standards is the world's most popular quality management system, and it has become the standard for data accreditation. The two most applicable implementations of this are the Intergovernmental Oceanographic Commission (IOC)/International Oceanographic Data and Information Exchange (IODE) Quality Management Framework Accreditation[2] and the World Data System (WDS) – Core Trust Seal Certification (CTS)[3]. The IODE accreditation follows the ISO 9001 standard for Quality Management and the CST accreditation has three subtypes following different standards, described below. Both accreditations are part of the ICSU WDS. A brief description of the requirements for both these accreditations follows below.

1 http://community.ices.dk/Committees/DIG/DIG%202019/02.%20Background%20documents/2019-02_Bur_Doc_2125_Data(2).pdf

2 https://iode.org/index.php?option=com_content&view=article&id=385&Itemid=34

3 https://www.coretrustseal.org/about/

7.3 IODE Quality Management Framework (QMF)

IODE is a programme of the IOC of UNESCO. The IODE QMF is part of the IODE programme. IODE's main target client for accreditation are National Oceanographic Data Centres, although repositories with other data types may apply, as long as the requirements are met. There are a total of 14 requirements across 4 categories (Annex 1).

Repositories have a period of 2 years to apply for accreditation. The procedure consists of:

a) submission of the accreditation request (including the IODE Accreditation Requirements and Report Format) and associated documentation to the SG-QMF through its Chair;
b) review of the documentation referred to under a) by the Steering Group within three months after submission;
c) formulation of recommendation regarding accreditation for consideration by the IODE Committee (within two months after b);
d) decision by the IODE Committee (during IODE Committee Session), and
e) report to applicants and publication on IODE web site (within two months after IODE Committee Session).

This process can take a time of up to 7 months after submission of the accreditation request. In case of an unsuccessful application, the applicant has 1 year to correct the failures. If a year is not enough, a new application must be made at a later time. Therefore the accreditation process can take up to 1 year and 7 months from application submission. The IODE accreditation process can be even lengthier, depending on when the application is submitted, since the IODE committee only meets every two years. If ICES decides to pursue the IODE accreditation, it will, when successful, be awarded the status of "Accredited IODE National Oceanographic Data Centre", independently of the existence of other data types in its database.

7.4 Core Trust Seal (CTS)

Unlike the IODE, the CTS accreditation was not built with a specific data type in mind, the main concern behind this accreditation is repositories complying to certain standards to ensure data quality, usefulness and archiving. This accreditation has three subtypes of accreditation, and applications for each are evaluated using different standards:

a) Core certification, which follows community-based norms granted to repositories which obtained the Data Seal of Approval or WDS membership;
b) Extended certification, which follows DIN 31644/nestor Seal standards, and
c) Formal certification, which follows ISO 16363 standards.

Repositories applying for certification, apply to the core certification and can pursue a higher certification at a later time. The structure of the CTS accreditation is, however, under revision and this might soon change. The current accreditation process consists of:

a) requesting an application;
b) submitting questions to the secretariat - these are not meant to be a pre-evaluation of the application;
c) submitting an application and paying a 1 000 € processing fee;
d) peer review of application by two people (within 2 months of payment), and
e) receiving certification granted and made public, or

f) receiving feedback from peer reviewers and re-submitting the application (for a maximum of 5 times, and each response taking up to 1 month), and finally
g) receiving certification granted and made public, or having it rejected.

In case all 5 rounds of feedback are used and the 1 month deadline is respected, certification could take up to 7 months, from submission. The accreditation process does not involve a site visit, therefore the requirements should be supported by links to public evidence, when possible. When publicly sharing information is impossible due to, for example, security reasons, provisions within the accreditation process are made to ensure that sensitive information remains confidential. Repositories must be re-assessed every three years and the processing fee must be paid for each re-assessment.

The CTS accreditation has sixteen requirements across four categories (Annex 2) and for a repository to be granted this accreditation, all requirements must be either fully implemented or, at least, in the implementation phase.

7.5 Discussion points

Even though the ICES Data Centre would need to make an investment of effort to meet some of the requirements of either accreditation, most of the protocols needed to be granted accreditation are already in place in various forms. Proper documentation of these protocols will have to be made before the ICES data centre applies for accreditation. This will require additional effort, which remains unquantifiable at this stage.

The two accreditations under consideration have similar standards, and both have their advantages and disadvantages. The IODE requires no processing fee and has already been obtained by some of the ICES partners who could provide guidance during the application preparation process. However, the IODE can take significantly more time from submission to accreditation and the application process is not transparent as the information is hard to find and is scattered across many web pages. Furthermore, this accreditation is very data type focused and, even though that is not a reason to fail in being granted accreditation, this might affect the perception of data owners who deal with data that are neither oceanographic nor biological (eg. VMS data).

Where the IODE might be weaker is where the CTS accreditation is probably strongest. The application process is extremely transparent with the CTS and potentially more responsive, with the maximum timeline from application to submission, granted that deadlines are followed, taking one year less than the IODE equivalent timeline. In the CTS web page, successful applications can be found and consulted prior to submission. The CTS accreditation has been obtained by some of the ICES partners, and advice during the application preparation process could be given by them. Further doubts regarding requirements can also be submitted to the CTS secretariat during the application process, before submission. The CTS is data type independent, being a measure of overall data quality, re-usability and archival abilities, and thus potentially having a broader definition of what the standards should be. However, the CTS accreditation requires paying a 1 000€ fee.

It should be noted that whichever accreditation ICES chooses to pursue, this does not preclude the subsequent pursuit of another accreditation option. These are not mutually exclusive and the choice made should only be viewed as a first step in having the ICES data centre accredited.

7.6 Key points for DIG input

- What is the perceived quality of each accreditation?
- Should application response time be a consideration?
- Is transparency of the application process important to ICES?
- The merits of CTS being data type independent vs IODE being oceanography (and now biology) data focused, and the impact it might have on possible new clients.
- Does the CTS processing fee affect the perception of this accreditation?

Table 1. IODE accreditation requirements

Organizational framework		
R1.1.	Quality management system	The NODC shall estabilish and maintain a quality manual that includes the scope of the quality management system, documented procedures estabilished for the quality management system, and a description of the interaction between the processes of the quality management system. Details of any QMS accreditation attained should be stated.
R1.2.	Proof of expertise and reputation in the area of oceanographic data management	The NODC shall describe the range and length of expertise of both the organisation and their staff. Details of datasets and products available from the NODC should also be provided. Any appropriate affiliations (e.g. national or international bodies, etc.) should be noted.
R1.3.	Commitment to provice sufficient resources for NODC operations	The NODC shall provide evidence that it is hosted by a recognized institution to ensure long-term stability and sustainability. Sufficient funding, including staff resources, IT resources and a budget for attending meetings, should be provided, ideally for a 3 to 5 year period.
R1.4.	Commitment to return data holdings to originators or lodging with an alternative repositoru, if the NODC becomes unsustainable	A long-term stewardship plan should be available including a statement on how the NODC is funded and for how long and also an action to be taken in the event that the NODC becomes unsustainable.
R1.5.	Provide national reports to the IODE Committee	The NODC shall provide a national report to each session of the IODE Committee in accordance with the standard format provided.
Quality control and maintenance		
R2.1.	Adherence to IODE standards and best practice	The NODC must provide evidence of adherence to IODE recommended standards and best practice to ensure the quality of exchanged data. For more information see IODE/JCOMM Ocean Data Standards and the JCOMM Catalogue of Best Practices and Standards.
R2.2.	Maintain a discovery metadata catalogue	The NODC shall maintain a discovery metadata catalogue that will store metadata about their datasets. ISO 19115 (Geographic Information - Metadata) is the international standard that sets out a number of metadata fields for descriving spatial information datasets. ISO 19139 (Geographic Information - Metada XML schema implementation) os the standard that aims to define an XML enconding for the metada elements defined in ISO 19115. The ISO 19115 metadata standard (or a profile) is to be used to generate metada records.
R2.3.	Ensure data are collected according to defined quality principles and accepted procedures	The NODC should be able to advise on data collection procesures and should be able to direct data collecting organisations to appropriate standards, where these exist. Provide details of data guidelines used for the collection of data.
R2.4.	Description of quality control procedures applied to data	The NODC should provice descriptions of quality control procedures and algorithms that are used to preocess data. This should include references to the quality flag system used.
User access and communication		
R3.1.	Committed to, and focused on, costumer service	The NODC should be committed to costumer service and should provice information on response times to enquires for data and information; description of aimed service level for responding to user requests (if unavailable online); whether an enquirires or help desk is available, and details of surveis of costumer satisfaction undertaken.
R3.2.	Committed to raising awareness of the holdings and promoting the use of the data	Describe facilities available at the NODC for the data Discovery-Access-Retrieval including details of how the data can be searched. Furthermore, the NODC should provice information on the data products available; the linkages with other organisations who use the data for generation of products; the currect projects aimint to increase and promote data use, and satistics/metrics indicating data usage.
R3.3.	Published data policy and adherence to the IOC Oceanographic Data Exchange Policy	The NODC should have a policy on data access. In general, the NODC should aim to make data and metadata freely avaiable, although it is recognised there may be restrictions on access to data for a number of reasons. The data access policy should include details of what data are accessible; licensing arrangements; the format(s) the data can be provided in; the media used for providing data (if not online); any costs associated with data provision, including cost of media, as well as staff time. Adherence to the IOC Oceanographic Exchange policy is mandatory.
Technical infrastructure		
R4.1.	Description of hardware and software systems used to manage and archive data	The NODC shall provide documentation on the data centre's operating enviroment (hardware, software). This should be appropriate to the services provided to its costumers.
R4.2.	Security Policy outlining the infrastructure for protection of the facility and its data, products and services	The NODC should have a security policy describing how the data holdings are protected from both malicious and accidental loss. A policy should include details on how the holdings are physically protected; acess to the network - what is the access policy, and details on virtual security of the network; policy when staff leave the organisation, and description of the data archival system including backup and off-site storage procedures. Note that the security policy should exist, but should not be made public, as it potentially exposes vulnerabilities.

Table 2. CTS accreditation requirements

Background Information		
R0.	Context	Repository Type.
		Brief Description of the Repository's Designated Community
		Level of Curation Performed.
		Outsource Partners, if applicable.
		Other Relevant Information
Organizational Infrastructure		
R1.	Mission/Scope	The repository has an explicit mission to provide access to and preserve data in its domain.
R2.	Licenses	The repository maintains all applicable licenses covering data access and use and monitors compliance.
R3.	Continuity of access	The repository has a continuity plan to ensure ongoing access to and preservation of its holdings.
R4.	Confidentiality/Ethics	The repository ensures, to the extent possible, that data are created, curated, accessed, and used in compliance with disciplinary and ethical norms.
R5.	Organizational infrastructure	The repository has adequate funding and sufficient numbers of qualified staff managed through a clear system of governance to effectively carry out the mission.
R6.	Expert guidance	The repository adopts mechanism(s) to secure ongoing expert guidance and feedback (either inhouse, or external, including scientific guidance, if relevant).
Digital Object Management		
R7.	Data integrity and authenticity	The repository guarantees the integrity and authenticity of the data.
R8.	Appraisal	The repository accepts data and metadata based on defined criteria to ensure relevance and understandability for data users.
R9.	Documented storage procedures	The repository applies documented processes and procedures in managing archival storage of the data.
R10.	Preservation plan	The repository assumes responsibility for long-term preservation and manages this function in a planned and documented way.
R11.	Data quality	The repository has appropriate expertise to address technical data and metadata quality and ensures that sufficient information is available for end users to make quality-related evaluations.
R12.	Workflows	Archiving takes place according to defined workflows from ingest to dissemination.
R13.	Data discovery and identification	The repository enables users to discover the data and refer to them in a persistent way through proper citation.
R14.	Data reuse	The repository enables reuse of the data over time, ensuring that appropriate metadata are available to support the understanding and use of the data.
Technology		
R15.	Technical infrastructure	The repository functions on well-supported operating systems and other core infrastructural software and is using hardware and software technologies appropriate to the services it provides to its Designated Community.
R16.	Security	The technical infrastructure of the repository provides for protection of the facility and its data, products, services, and users.

8 Annex 2: Data delivery deadlines

Note all databases offer continuous data delivery, however deadlines are set for specific end use needs to ensure data are available.

Dataflow[1]	Portal	J	F	M	A	M	J	J	A	S	O	N	D
Bottom Trawl Survey (Biotic)	DATRAS												
Bottom Trawl Survey (Seafloor litter)	DATRAS												
Pelagic survey (Acoustic)	ACOUSTIC												
Pelagic survey (Biotic)	ACOUSTIC												
Catch Data (Detailed Commercial)	RDB												
Catch Data (Detailed/Aggregated Commercial)	InterCatch												
Catch Statistics (Aggr. preliminary Commercial)	REC12												
Catch Statistics (Aggr. Commercial)	CATCHES												
Bycatch of protected species	BYCATCH												
Oceanic hydrography	OCEAN												
Seabird biodiversity	BIODIVERSITY												
Marine contaminants	DOME												
Biological Community	DOME												
Eggs and Larvae	EGGS												
Underwater Noise (Impulsive)	NOISE												
Vulnerable Marine Ecosystems (VME)	VME												
VMS/Logbook	VMS												

1 Yellow colour denotes externally controlled delivery deadlines