

Data Science and Technology Steering Group EGs Resolutions

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Overview of expert groups transferred to Data Science and Technology Steering Group (DSTSG)

The following expert groups will be parented by the Data Science and Technology Steering Group from 1 January 2021:

GROUP	ACRONYM	CURRENT SG	CHAIR(S)
Working Group on Fisheries Acoustics, Science and Technology	WGFAST	EOSG	J. Michael Jech, USA
Working Group on DATRAS Governance	WGDOG	EOSG	Ingeborg de Boois, Netherlands
Working Group on Recreational Fisheries Surveys	WGRFS	EOSG	Kieran Hyder, UK, and Keno Ferter, Norway
Working Group on the Acoustic Trawl Data Portal Governance	WGAcousticGOV	EOSG	Ciaran O'Donnell, Ireland
Working Group on Spatial Fisheries Data Governance	WGSFDGOV	HAPISG	Christian von Dorrien, Germany
Workshop on Acoustic Backscatter Models	WKABM	EOSG	Sven Gastauer, Germany
Working Group on Commercial Catches	WGCATCH	EOSG	Kirsten Birch Håkansson, Denmark, and Estanis Mugerza, Spain
Workshop on Operational Implementation of Stomach Sampling	WKOISS	EOSG	Pierre Cresson, France and Maria Valls, Spain
The Fourth Workshop on Optimization of Biological Sampling	WKBIOPTIM4	EOSG	Gwladys Lambert, UK, Isabella Bitetto, Italy, and Patricia Gonçalves, Portugal
Working Group on SmartDots Governance	WGSMART	EOSG	Julie Coad Davies, Denmark, and Jane Aanestad Godiksen, Norway
Working group on machine learning in marine science	WGMLEARN	EOSG	Ketil Malde, Norway, and Jean-Olivier Irisson, France
Working Group on Technology Integration for Fishery-Dependent Data	WGTIFD	EOSG	Brett Alger, USA, and Lisa Borges, Portugal
Working Group on Atlantic Larval and Egg Surveys	WGALES	EOSG	Patrick Polte, Germany, and Cristina Nunes, Portugal
Working Group on Biological Parameters	WGBIOP	EOSG	Annelie Hilvarsson, Sweden, Maria Cristina Follesa, Italy, and

			Sally Songer, England
Working Group on Governance of the Regional Database & Estimation System ¹	WGRDBESGOV	EOSG	David Currie, Ireland, and Katja Ringdahl, Sweden
Working Group on the Governance of Quality Management of Data and Advice	WGQuality	-	David Currie, Ireland
Workshop on Age reading of Sea bass (<i>Dicentrarchus labrax</i>) ²	WKARDL2	EOSG	Mary Brown, UK and Valerio Visconti, UK
Workshop on Age estimation of European anchovy (<i>Engraulis encrasicolus</i>)	WKARA3	EOSG	Gualtiero Basilone, Italy
Workshop on Estimation of Commercial Catches I – Ratio estimators	WKRATIO	-	Liz Clarke, UK-Scotland, and Laurent Dubroca, France

¹ Steering Committee for the Regional Database and Estimation System (SCRDB) has been renamed Working Group on Governance of the Regional Database & Estimation System (WGRDBESGOV).

Resolutions approved in 2019/2020

Working Group on Fisheries Acoustics, Science and Technology (WGFAST)

2019/FT/EOSG09 A Working Group on Fisheries Acoustics, Science and Technology (WGFAST), chaired by J. Michael Jech*, USA, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2020	22 April	Online meeting	Interim report by 22 May 2020 to ACOM-SCICOM	Michael Jech takes over as chair
Year 2021	19-23 April	Online meeting	Interim report by 30 June 2021 to ACOM-SCICOM	
Year 2022	TBD	TBD	Final report by 30 June 2022 to ACOM-SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Collate information on acoustic related research and surveys, and interactions with ecosystem and assessment expert groups.	a) Science Requirements b) Advisory Requirements A summary of the information will be presented in the final report	3.1, 3.2, 3.4	3	
b	Review presented recent work within the topics: “Acoustic methods to characterize populations, ecosystems, habitat, and behaviour”; “Acoustic characterization of marine organisms”; and “Emerging technologies, methodologies, and protocols”. Provide guidance by identifying: (1) where training opportunities could be developed; and (2) gaps in knowledge and challenges that should be prioritized by the community.	Create a venue for informing the group members on recent activities and seeking input to further development. An overview of the different contributions and guidance will be presented in the annual report	3.3, 4.1, 4.4	1, 2, 3	
c	Organize a conference session on integrating fisheries acoustics with ecosystem assessment		3.1, 3.2, 4.1	2 or 3	

	and monitoring at an international scientific meeting such as ASC.				
d	Develop, and maintain acoustic metadata and data format conventions and coordinate with acoustic survey groups.	Data format conventions for acoustic metadata and data are required for efficient data interchange and processing of acoustic data, but are lacking in the fisheries acoustics field. CRR 341 (2018) and SISP 4 (2016) have partially addressed this need, but further types of data and acoustic equipment need to be supported.	3.2, 3.5, 4.2	1, 2, 3	Updated metadata convention publication (new guide/handbook series) Revised sonar-netcdf4 convention publication that includes echosounder data (new guide/handbook series)
e	Develop and recommend procedures for collecting and processing quality acoustic data in inclement weather.	Acoustic data are collected from a variety of vessels that respond to inclement weather in diverse ways. Procedures are needed to provide quality control for data collected in inclement weather to stock assessment.	3.3, 3.6	1	CRR; recommendations on methodology improvements to acoustic survey coordination groups to implement on surveys and update SISPs

Summary of the Work Plan

Year 1	Produce the annual overview of recent developments within the field. Produce an ICES CRR recommending procedures for collecting and processing quality acoustic data in inclement weather. Develop and maintain metadata and acoustic data formats.
Year 2	Produce the annual overview of recent developments within the field. Propose a conference session at an international scientific meeting. Develop and maintain metadata and acoustic data formats.
Year 3	Produce the annual overview of recent developments within the field. Collate information on acoustic related research and surveys. Develop and maintain metadata and acoustic data formats. Publish new guides with updated metadata convention and revised sonar-netcdf4 convention publication that includes echosounder data.

Supporting information

Priority	Fisheries acoustics and complementary technologies provide the necessary tools and methods to implement the ecosystem approach to fisheries management within ICES and research into their application and further development is vital.
Resource requirements	No new resources will be required. Having overlaps with the other meetings of the Working, Planning, Study and Topic Groups increases efficiency and reduces travel costs.
Participants	The Group is normally attended by some 60-100 members and guests.
Secretariat facilities	None.

Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Stock assessment groups using acoustic abundance indices.
Linkages to other committees or groups	The work in this group is closely aligned with complementary work in the FTFB Working Group. The work is of direct relevance to a number of data collection and coordination groups within EOSG (e.g. WGIPS, WGBITS, WGISUR)
Linkages to other organizations	The work of this group is closely aligned with similar work in FAO, the Acoustical Society of America, the South Pacific Regional Fisheries Management Organization, the Commission for the Conservation of Antarctic Marine Living Resources, and the American Fisheries Society.

Working Group on DATRAS Governance (WGDG)

2019/FT/EOSG06 The Working Group on DATRAS Governance (WGDG), chaired by Ingeborg de Boois, Netherlands, will meet by web conference, four times per year and may also meet physically once per year, to work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2020	26-28 May	Online meeting	E-evaluation	
Year 2021	1) 28 January - Q1 2) TBD - Q2 3) TBD - Q3 4) TBD - Q4	Online meetings	E-evaluation	
Year 2022	May	Online meeting Copenhagen, Denmark (during DIG)	Final report by Date Month May to DSTSG and DIG	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Further evolve the framework on the governance of DATRAS	DIG had provided a governance framework to review a database in the broadest sense of the word. Transparency about the status of the ICES databases is crucial to maintain and improve the quality of the databases and the data.	3.2, 4.1, 4.2	Generic ToR	A functional and efficient framework with clear responsibilities and tasks for the governance of DATRAS.

b	Oversee and advise on the interpretation and prioritisation of recommendations from expert groups addressed to DATRAS	Three different groups (IBTSWG, WGBIFS, WGBEAM) currently provide the survey information directly to DATRAS, and some groups use the DATRAS format as a starting point for data submission (e.g. WGIPS). Overview of the general issues and developments is crucial to maintain the system effectively.	3.2, 4.1, 4.2	Generic ToR	A table of prioritised requests from data providers and data users for consideration by the data centre for improvements and updates to the data services on trawl and litter data based on the ICES data infrastructure.
c	Facilitate common functionality in terms of data providers and data user across different surveys to improve upload efficiency and allow broader perspectives (covered by more than one survey) can be effectively addressed.	Alignment over the surveys will facilitate automation processes at the submitter's side, and provide the opportunity to increase the information provided in the sets that have been in DATRAS from the start.	3.2, 4.1, 4.2	Generic ToR	
d	Provide a platform for end user feedback to the DATRAS system, as well as feedback on the outcomes of those suggestions.	A database filled by a significant number of institutes and used by many people and (stock) assessment groups needs to be kept up to date with respect to user requirements without ad-hoc solutions for everyone.	3.2, 4.1, 4.2	Generic ToR	Links to TOR b providing the input for that task in future.

Summary of the Work Plan

Year 1	Work on all terms of reference in four 1.5 hour skype meetings, provide oral report to data and information group (DIG)
Year 2	Work on all terms of reference in four 1.5 hour skype meetings, provide oral report to data and information group (DIG)
Year 3	Work on all terms of reference in four 1.5 hour skype meetings, provide oral report to data and information group (DIG), evaluate the relevance and functioning of the group

Supporting information

Priority	High. WGDG works to align DATRAS for the different surveys, evaluate the database for the Data and Information Group (DIG) and oversee future development of DATRAS. These tasks are well aligned with ICES strategic plan to continue to build our capacity and expertise in managing, analysing, and interpreting data to support science and advice.
Resource requirements	A commitment of time from the members of the group consistent with progressing actions identified in the quarterly meetings
Participants	Members of ICES Data Centre involved in DATRAS developments, chair with a direct link with (=participating in) DIG, representatives of survey groups submitting data to DATRAS (currently WGBIFS, IBTSWG, WGBEAM)
Secretariat facilities	Community Sharepoint site, Remote meeting facilities.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	This is an integral component to the overall Quality Assurance framework (of Advice) that ACOM together with the Coordination group are describing
Linkages to other committees or groups	There is a very close working relationship with the fish trawl survey groups. There is a strong linkage to DIG as the main umbrella for data/software governance structures.
Linkages to other organizations	No

Working Group on Recreational Fisheries Surveys (WGRFS)

2019/2/EOSG07 The Working Group on Recreational Fisheries Surveys (WGRFS), chaired by Kieran Hyder, UK, and Keno Ferter, Norway, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2020	15-19 June 2020	By correspondence	Interim report by 01 November 2020 to EOSG	Keno Ferter's 3 year term as chair ends
Year 2021	14-18 June 2021	TBC	Interim report by 01 November 2021 to DSTSG	Kieran Hyder's 3 year term as chair ends
Year 2022	13-17 June 2022	TBC	Final report by 01 November 2022 to DSTSG	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Collate and review quality of national estimates of recreational catch and effort, catch-and-release impacts, and socio-economic benefits for candidate stocks, identify	Most countries are engaged in data collection. This activity collates national participation, catch and socio-economic data sets together, understands the quality of data,	5.4	Regular activity in each year, with specific intersessional tasks to	Report WG perspectives and publication of scientific papers

	significant data gaps in coverage and species, and support the ICES TAF.	and highlights where new data are needed. This is important for supporting the ICES TAF.		develop new approaches.	
b	Assess the validity of traditional knowledge, new survey designs, novel methods (e.g. citizen science, apps), and innovative statistical methods for data provision.	Recreational data can be collected in many ways, with different associated biases. This supports improvement of analysis of existing surveys and understanding the utility of new methods. This will lead to the most robust and broad evidence-base to underpin assessment and advice.	3.1, 3.2, 3.3, 3.6, 4.1, 4.3, 5.4	Regular activity in each year	Report WG perspectives and publication of scientific papers
c	Provide guidance to ICES and respond to ad hoc requests from ACOM on the availability of data, design of data collection programs, data storage systems, use of data in assessments, and catch allocation.	Recreational catches are not included in many assessments and data collection is limited to a few species. This activity supports data collection requirements, access to data and methods needed. This will facilitate embedding recreational fisheries into fisheries management.	3.1, 3.2, 3.3, 3.6, 5.1	Regular activity in each year, with specific intersessional tasks to develop new approaches.	Report WG perspectives and publication of scientific papers
d	Develop approaches for regional data collection programmes that generate robust data for end users and support the ICES TAF.	Regionalisation is an important goal, but implementation is unclear. This is a challenge for recreational fisheries due to the different actors, gears and survey instruments. This will underpin generation of transparent and robust regional data to support end users needs.	3.1, 3.2, 3.3, 3.6,	Regular activity in each year.	Report WG perspectives and publication of scientific papers

Summary of the Work Plan

Year 1	<ol style="list-style-type: none"> 1) Establish intersessional groups and leads within WGRFS to progress key tasks including governance, survey design, quality and analysis, regional coordination, data storage, catch-and-release impacts, novel methods, assessment and catch allocation, human dimensions, and communication. (a, b, c, d, e) 2) Plan at least three WGRFS publications within the period 2020-22. (a, c, e, f) 3) Update the existing quality assessment tool (QAT) and embed this in the TAF (a,d). 4) Evaluate the quality of up to three national survey programmes using the QAT. (a) 5) Investigate animal welfare issues related to recreational fisheries (e.g. catch and
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	<p>release) and identify how these could impact management. (a)</p> <p>6) Assess the impact of recreational fisheries on a broad range of stocks using data from the pilot studies. (a, c, d)</p> <p>7) Create a framework for inclusion of recreational data in stock assessments and scope a workshop to design approaches. (a, c, d)</p> <p>8) Collate advances in survey methods that could be used to improved national approaches. (b)</p> <p>9) Develop a solution for storage of data within RDBES and agree with ICES. (c, d, f)</p> <p>10) Review existing governance structures and develop understanding of 'world class' recreational fisheries management that could be embedded in a future revision of the CFP. (e)</p> <p>11) Review outcomes from WKHDR and agree approach for inclusion of angler behaviour in future surveys. (f)</p>
Year 2	<p>1) Evaluate the outcomes form the intersessional work and agree approach for the next year. (a, b, c, d, e, f)</p> <p>2) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES. (a)</p> <p>3) Assess the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches, smartphone apps, traditional knowledge). (b)</p> <p>4) Develop a framework for allocation of catches between sectors based on a review of existing systems and provide best-practice guidance. (c,d)</p> <p>5) Develop MSE approaches to assess the impact of uncertainty in recreational catches on assessment and regional samplin programme. (d).</p> <p>6) Review and share methods for engaging with stakeholders and the potential for participatory approaches. (e)</p> <p>7) Assess outcomes of workshop on inclusion of recreational data in stock assessments. (f)</p>
Year 3	<p>1) Evaluate the outcomes form the intersessional work and agree approach for the next year. (a, b, c, d, e)</p> <p>2) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES. (a)</p> <p>3) Evaluate post-release mortality estimates, potential sublethal effects, and reasonable extrapolations across species and fisheries for inclusion in stock assessments. (a)</p> <p>4) Assess novel approaches for surveys (e.g. combining probabilistic and non-probabilistic sampling) and analysis methods (e.g. treatment of outliers, machine learning). (b)</p> <p>5) Assess the potential for impact of climate change on species caught by recreational fisheries and how that could impact on DCF and regional species requirements. (c, d)</p> <p>6) Review the potential for food safety and human health issues from consumption of recreational caught fish (e.g. environmental toxins). (e)</p> <p>7) Evaluate progress against three year plan and develop new ToRs. (a, b, c, d, e, f)</p>

Supporting information

Priority	High – the biological, social and economic impact of recreational fisheries is becoming increasing recognised and needs to be included in the fisheries assessment and management processes.
Resource requirements	
Participants	The Group is normally attended by around 40 members and chair-invited experts.
Secretariat facilities	Normal backstopping support in the organization of the group.

Financial	None
Linkages to ACOM and groups under ACOM	ACOM, WGBFAS, WGEEL, WGBAST, WGCSE, WGNSSK, WGBIE, WGMEDS, and benchmarks workshops for stocks that have recreational catches.
Linkages to other committees or groups	PGDATA, WGCATCH,
Linkages to other organizations	EC, STECF, Regional Coordination Groups, Advisory Councils WECAFC/OSPESCA/CRFM/CFMC/MEDAC Working Group on Recreational Fisheries Many linkages to (inter)national angling associations, since WGRFS members estimate national marine recreational catches. Links to broader organizations with interests in angling and fisheries management including EIFACC and FAO.

Working Group on the Acoustic Trawl Data Portal Governance (WGAcousticGOV)

2019/FT/EOSG15 The **Working Group on Acoustic Trawl Data Portal Governance (WGAcousticGov)**, chaired by Ciaran O'Donnell (Ireland), will meet by web conference, four times per year and may meet physically once per year, to work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2020	14 September & 10 December	Online meetings	E-evaluation	
Year 2021	1) 25 February - Q1 2) May - Q2 3) September - Q3 4) December - Q4	Online meetings	E-evaluation	
Year 2022	May	Online meetings	Interim report by September to DSTSG	

WGAcousticGov will report on its activities by the March ACOM and SCICOM meetings in the form of a business report the following year to DSTSG and WGFAS.

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Establish a governance framework setting out a forward looking plan, including objectives of the Acoustic Trawl Data Portal, responsibilities, processes and resources.	In order to successfully develop and maintain a workplan for the Acoustic Trawl Data Portal, it is necessary to first establish a vision for the future supported by guidelines on project management, handling of feedback, task prioritisation and	3.2, 4.1, 4.2	3 years/ Generic ToR	The WGAcousticGov manifesto: Mission statement on the direction of the Acoustic Trawl Data Portal development and overarching short to medium terms goals.

		expected resource availability.			Guidelines on how to prioritise Definition of resources available Definition of responsibilities.
b	Provide a platform for end user feedback to the the Acoustic Trawl Data Portal. according to the groups guidelines.	The Acoustic Trawl Data Portal should be develop to meet the requirements of end users and thus needs to be responsive to user feedback. To achieve a long-term stability, availability and quality, the Acoustic Trawl Data Portal development requires a workplan with clear objectives and milestones. This can only be sucessfully implemented when resource requirements have been estimated and the availability of resources in known.	3.2, 4.1, 4.2	3 years/Generic ToR	A github site to allow users to submit feedback and requests. Provide an annual workplan, with an agreed and prioritised list of Acoustic related expert group recommendations along with suggested resource allocation , budget estimates and feasibility estimates.
c	Coordinate and advise on the interpretation and prioritisation of recommendations, the groups guidlines and requests addressed to the Acoustic Trawl Data Portal.	The project planning cycle needs to be responsive (more than one meeting a year) in order to the Acoustic Trawl Data Portal development effectively. Although there is an annual plan, short term priorities must be evaluated against resource availability and needs of the ICES advice processes that vary through the year.	3.2, 4.1, 4.2	3 years/ Generic ToR	
d	Coordinate the development of user guidance and training for the Acoustic Trawl Data Portal.	As the Acoustic Trawl Data Portal develops over time a range of users will require various levels of training including step by step user manuals, tutorials and workshops. Documentation of guidelines and	3.2, 4.1, 4.2	3 years/ Generic ToR	Annually updated training documentation. Workshops with specific goals proposed and planned where necessary. Relevant fora for dissemination

	procedures will also be necessary. Outreach activities will be required.	investigated and outreach activities planned.
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Summary of the Work Plan

Year 1	First meeting to establish ToRs a) and b) will be conduct via WebEx and followed by subsequent quarterly WebEx meetings in 2020 dealing with ToR c) and d). First physical meeting has not been determined and will most likely not take place in 2020 due to COVID-19 travel restrictions.
Year 2	ToRs c) and d) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with WGFAST for prioritising ToR b), with potential review of ToR a).
Year 3	ToRs c) and d) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with WGFAST for prioritising ToR b), with potential review of ToR a).

Supporting information

Priority	High priority
Resource requirements	No additional resource requirement for ICES. A commitment of time from the members of the group consistent with progressing actions identified in the quarterly meetings
Participants	Survey planning groups; WGIPS, WGBIFS, WGACEGG, WGIDEEPS, expert groups WGFAST and WGFTFB and assesment working groups; WGWIDE, HAWG and WGHANSA. One or more members from each WG representing data providers, data users and relevant expert groups. ICES Secretariat and other related EG members as need be.
Secretariat facilities	Community Sharepoint site, Remote meeting facilities
Financial	No financial implications
Linkages to ACOM and groups under ACOM	This is an integral component to the overall Quality Assurance Framework (of Advice) that ACOM together with the Coordination group are describing
Linkages to other committees or groups	There is a strong linkage to DIG as the main umbrella for data/software governance structures.
Linkages to other organizations	NOAA via participation by members of WGFAST have expressed interest in joining the group system.

Working Group on Spatial Fisheries Data Governance (WGSFDGOV)

2019/FT/HAPISG08 A Working Group on Spatial Fisheries Data Governance (WGSFDGOV), chaired by Christian von Dorrien*, Germany, will be established and will meet 4 times per year via WebEx and may meet physically once per year in association with DIG, to work on ToRs and generate deliverables as listed in the Table below.

	<u>WEBEX Meeting dates</u>	<u>Meeting dates and Venue</u>	<u>Reporting details</u>	<u>Comments (change in Chair, etc.)</u>
Year 2020	1) 4 February - Q1 2) 28 May - Q2 3) 2 September - Q3 4) 10 December - Q4	Online meetings	E-evaluation	
Year 2021	1) 25 February - Q1 2) TBD - Q2 3) TBD - Q3 4) TBD - Q4	Online meetings	Interim report to DIG and DSTSG	
Year 2022	1) TBD - Q1 2) TBD - Q2 3) TBD - Q3 4) TBD - Q4	Dates and venue as DIG	Final report by DATE to DIG and SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Establish a governance framework setting out a forward looking plan, including objectives of the Acoustic Trawl Data Portal, responsibilities, processes and resources.	In order to successfully develop and maintain a workplan for the Acoustic Trawl Data Portal, it is necessary to first establish a vision for the future supported by guidelines on project management, handling of feedback, task prioritisation and expected resource availability.	3.2, 4.1, 4.2	3 years/ Generic ToR	The WGAcousticGov manifesto: Mission statement on the direction of the Acoustic Trawl Data Portal development and overarching short to medium terms goals. Guidelines on how to prioritise Definition of resources available Definition of responsibilities.
b	Based on the guidelines established in ToR A: Provide a platform for user feedback to the VMS and Logbook DB. Feedback will be compiled by WGSpatialFisheriesDataGov and appropriate actions to be taken with assigned responsibilities and resource requirements will be listed and prioritised.	The VMS DB should develop to meet the requirements of a broad range of users and thus needs to be responsive to user feedback. Feedback will be collected and organised using GitHub and the traditional recommendations system from ICES reports. To achieve a long-term stability, availability and quality, the VMS and Logbook DB development requires a	4.2, 5.4	3 years/ Generic ToR	A GitHub site allowing users to submit feedback and requests. Provide an annual workplan, with an agreed and prioritised list of VMS DB related EG recommendations along with suggested resource allocations, budget estimates and feasibility estimates.

		workplan with clear objectives and milestones. This can only be successfully implemented when resource requirements have been estimated and the availability of resources is known.			
c	Using the guidelines established in ToR A and the feedback captured in ToR B: Oversee and advise on the interpretation and prioritisation of recommendations and requests addressed to the VMS and Logbook DB.	The project planning cycle needs to be responsive (more than one meeting a year) in order to manage the the VMS and Logbook DB development effectively. Although there is an annual plan, short term priorities must be evaluated against resource availability and needs of the ICES advice processes that vary through the year.	3.2, 3.5,	3 years/ Generic ToR	Establish and maintain a project board on GitHub to manage tasks. Review project plan and agree on tasks to be completed. Review new tasks for addition to the workplan, or for consideration for the next annual workplan.
d	Oversee development of data submitter guidance and training for VMS and Logbook DB.	Data submitters require various levels of training including step by step user manuals, tutorials and workshops. Maintenance of documentation of guidelines and procedures will also be necessary.	3.2, 3.5	3 years/ Generic ToR	Annually updated training documentation and workflow. Workshops with specific goals proposed and planned where necessary.

Summary of the Work Plan

Year 1	First meeting to establish ToRs a) and b) will be a physical meeting to be followed by quarterly WebEx meetings dealing with ToR c) and d). First annual meeting intended to coincide with DIG for prioritising ToR b) and review of ToR a)
Year 2	ToRs c) and d) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with DIG for prioritising ToR b), with potential review of ToR a)
Year 3	ToRs c) and d) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with DIG for prioritising ToR b), with potential review of ToR a)

Supporting information

Priority	High priority.
Resource requirements	A commitment of time from the members of the group consistent with progressing actions identified in the quarterly meetings.

Participants	DIG and WGSFD representatives, one member each representing data submission, data policy and data use. ICES Secretariat and other related EG members as need be.
Secretariat facilities	Standard (Sharepoint site, remote meeting facilities)
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	This database is an integral component of many groups and products created by ICES EGs, such as Fisheries overviews, WKTRADE, WGBEDPRES, etc..
Linkages to other committees or groups	There is a strong linkage to WGSFD as the group which has coordinated the VMS and logbook data call and quality control of data submissions and products. There is also a strong linkage to DIG as the main umbrella for data/software governance structures.
Linkages to other organizations	OSPAR, HELCOM, RCG, NAFO.

Workshop on Acoustic Backscatter Models (WKABM)

2019/2/EOSG16 The **Workshop on Acoustic Backscatter Models (WKABM)**, chaired by Sven Gastauer*, Germany, will be established and will meet online, 7-8 April 2021, in conjunction with WGFAST to:

- a) Review and select commonly used acoustic scattering models and their application/relevance to fisheries acoustics in relation to various objectives; ([Science Plan codes: 4.4](#)).
- b) Review and select methods to organize digital morphology and anatomical data of aquatic organisms (including data formats, segmentation processes, meshing techniques); ([Science Plan codes: 4.4](#)).
- c) Review / recommend software platforms and languages in which to develop and disseminate the open source acoustic scattering models (with respect to availability, processing speed, precision, transparency and simplicity); ([Science Plan codes: 4.4](#)).
- d) Recommend benchmark methodology to compare acoustic scattering models to canonical shapes and field data, including defining boundary conditions and providing clear guidance on the circumstances individual scattering models can be used; ([Science Plan codes: 4.4](#)).
- e) Develop a set of standardized shapes including a fish body, a fish swimbladder, a backbone, and a zooplankton (e.g., krill) to test and compare acoustic scattering models (including different resolutions and meshing techniques, where needed); ([Science Plan codes: 4.4](#)).
- f) Discuss the need for future training programmes on the subject of scattering models; ([Science Plan codes: 4.4](#)).

WKABM will report by 30 June 2022 for the attention of WGFAST, WGIPS, and SCICOM Committees. Additionally, reports and data will be posted to the WKABM's ICES GitHub site.

Supporting information

Priority	This workshop will bring experts together to define and scope a coordinated effort to disseminate acoustic scattering models in open-source fora. Workshop results and recommendations affect processing of acoustic data that are used in stock assessments of pelagic species and the wider pelagic ecosystem. Consequently, these activities are considered to have a very high priority.
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Scientific justification	Terms of Reference a-e) The translation of acoustic energy to biologically meaningful metrics such as numeric density, abundance, and biomass relies on accurate knowledge of acoustic target strength. Acoustic scattering models provide a theoretical foundation for empirical measures of target strength, but these models have been the purview of acousticians and mathematicians. Many of these models are now mature enough so that they can be used by the broader community. One way to bring these models to the community is through open source and open access software. WGFAST proposes to conduct a workshop to initiate this effort and scope strategies for effective development and provision of target strength models to the fisheries acoustics community.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	Members of WGFAST and guests (15-20 participants expected).
Secretariat facilities	WKABM GitHub repository in the ICES GitHub repository.
Financial	No financial implications.
Linkages to advisory committees	There are no obvious direct linkages with the advisory committee.
Linkages to other committees or groups	There are linkages to SCICOM. There are linkages to all groups currently planning acoustic surveys or using acoustic survey data like WGIPS, WGACEGG, and WGBIFS.
Linkages to other organizations	The work of this group is of international interest to all countries conducting biomass estimation surveys, and to national and international acoustical societies like the Acoustical Society of America and the European Acoustics Association.

The Fourth Workshop on Optimization of Biological Sampling (WKBIOPTIM4)

2019/2/EOSG13 The Fourth Workshop on Optimization of Biological Sampling (WKBIOPTIM4) chaired by Gwladys Lambert (UK), Isabella Bitetto (Italy) and Patricia Gonçalves (Portugal) will meet in Bari, Italy, 15–19 November 2021 to:

- a) Develop further indicators of length and age frequency data by i) testing the different indicators and quality thresholds using simulations and ii) preparing an R-package with the functions used to calculate them; ([Science Plan codes: 3.3](#));
- b) Consolidate and update existing open source code used in previous workshops (BIOPTIM 1-3) and generalize for wider use, , package code and document tools, and assess compatibility of tools with use of standard data formats and sources; ([Science Plan codes: 3.2](#));
- c) Continue to provide support on the use of WKBIOPTIM tools with the aim of a future optimization at national/stock/regional levels. ([Science Plan codes: 3.2 and 3.3](#)).

WKBIOPTIM 4 will report by 15 December 2021 for the attention of the Ecosystem Observation Steering Group, ACOM and SCICOM.

Supporting information

Priority	This workshop is considered to have a high priority for already established and new commercial fishery and survey sampling programmes developed under the EU-MAP, or for any fisheries data collection schemes with similar scope, such as surveys or recreational fisheries.
Scientific justification	Statistical sound sampling is very important, if not essential for any sampling scheme. One important component of a “statistically sound design” is that sampling effort is optimized and fit for purpose, i.e. that time and costs spent in sampling can be effectively justified in terms of quality of the information finally provided to end-users The Workshops on Optimization of Biological Sampling (WKBIOPTIM 1, 2, and 3) developed, improved and tested a set of R-scripts (mostly based on the RBD exchange format) producing a range of statistical and graphical outputs to be used for discussion of appropriate levels of biological sampling of different stocks. This workshop aims to consolidate the new knowledge from those workshops into tools and start development on further analyses.
Resource requirements	No additional ICES resources required
Participants	The Workshop is expected to attract wide interest from those involved in WGCATCH and WGBIOP and should include a subset of participants familiar with R-coding to the level of “loop coding” and “function building” and a subset of participants experienced in age and reproduction analysis. In view of its relevance to data collection within ICES, the EU-MAP and regional sampling designs, it should include those involved in the annual planning of sampling and laboratory analysis. Members of survey groups located under EOSG should also be among the participants.
Secretariat facilities	Some secretarial support will be needed.
Financial	Member States may fund this through their EMFF programme
Linkages to advisory committees	ACOM
Linkages to other committees or groups	SCICOM, WGCATCH, WGBIOP, PGDATA, EOSG, Survey WGs (IBTS, IBAS, etc.)
Linkages to other organizations	RCGs. GFCM

Working Group on Commercial Catches (WGCATCH)

2016/2/SSGIEOM23 A Working Group on Commercial Catches (WGCATCH), chaired by Kirsten Birch Håkansson (Denmark), and Estanis Mugerza* (Spain) will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2020	09-13 November	Online meeting	Interim report by 15 January to EOSG	Estanis Mugerza (Spain) is new co-chair for 2020-2022; Kirsten Birch Håkansson (Denmark) ends 3-yr term as chair; new co-chair will be appointed
Year 2021	To be determined	To be determined	Interim report by 15 January to DSTSG	

Year 2022	To be determined	To be determined	Final report by 31 January to DSTSG	Estanis Mugerza (Spain) ends 3-yr term as co-chair; new co-chair will be appointed
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ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Review and update guidelines and best-practices for implementation of statistically sound catch sampling and estimation thereof.	<p>Many ICES member states are moving towards more probabilistic catch sampling designs. For consistent data use in time series it is necessary to document these changes and to update guidelines and procedures, particularly in regard to practical sampling issues that make a strict probabilistic approach unfeasible as demonstrated by case studies. The update will revise the survey designs classes for catch-sampling programs (WKPICS) in the light of the RDBES and couple it with basic design-based estimation. With ICES moving to a transparent framework for estimating catch parameters, and thereby putting more focus on estimation, good guidelines are needed to support this transition.</p> <p>There is also an increasing need to design commercial sampling programmes in multi-purpose context, to answer the multiple end-users needs. WGCATCH will continue to propose and endorse WK with the aim of a future optimization at national/stock/regional levels. WKRARE will be planned together with WGBYC.</p> <p>There are increasing examples of the use of other data sources (e.g. grading machines, EM technology) that could be used in estimation. Therefore, there is need to develop guidelines on how QA data and how to combine different data sources. This</p>	3.1, 3.2, 3.3, 3.5, 3.6	3 years	<ul style="list-style-type: none"> • Based on real case studies produce a Cooperative Research Report (CRR) with updated guidelines for on-shore and off-shore sampling of commercial catches (2022). • Develop 3 workshops on estimation <ul style="list-style-type: none"> ○ Ratio estimations, WKRATIO (2021) ○ Post-stratification, WKPOST (2021) ○ Estimation of rare species or events, WKRARE (2022) • Based on WKRATIO produce a Cooperative Research Report (CRR) with best practice guidelines for choosing and using ration estimators (2022)

		needs to be developed in cooperation with WGTIFD.			
b	Review developments in sampling and estimation practices of catch, effort, length and age distributions and other biological parameters of small scale fisheries	<p>WGCATCH continues to review developments for collection of transversal variables (landings, discards and PETS by species, fishing effort) and biological data, length and age distributions, other biological parameters) in small-scale fisheries (SSF) to ensure that the collection of fishing data from SSF across ICES member countries are sufficient, harmonised and comparable and to improve their effectiveness.</p> <p>During its term the WG will focus mainly on five? aspects: 1) evaluate the implementation of guidelines for transversal variables and continue the development of quality indicators and quality checking methodologies ; 2) document sampling effort and develop guidelines for biological data (length and age distribution, other biological parameters) sampling on SSF; 3) knowledge-sharing on how to improve data collection for SSF (e.g. add a social dimension to understand how to improve data collection, assess the usefulness of sampling approaches, use of new technologies), 4) analysis of the catch fraction of the SSF to evaluate the impact in the populations of different target species and 5) continue to work on the proper integration of SSF data with their specificities into the RDBES database</p>	3.1, 3.2, 3.3, 3.5, 3.6	3 years	<ul style="list-style-type: none"> • Update and refine risk assessment for transversal data quality methodology developed in 2018/2019 (comparison with Large Scale Fleets and scientific estimates) – 2020 • Document sampling effort of biological data on SSF – 2020 • Develop guidelines for SSF biological data sampling. 2021-2022 • Peer-review publication on SSF- 2020 • Continue to develop best practices guidelines on sampling and census data for SSF transversal variables-and evaluate its implementation 2020-2022
c	Review developments in sampling and estimation of incidental by-catch of Protected, Endangered and Threatened Species (PETS) and other rare species and ensure that	The sampling and estimation of incidental catches of PETS and other rare species in commercial fisheries has been a long-term ICES concern. WGBYC and WGCATCH are two ICES EGs involved in data compilation and estimation of such rare events and impacts and have been collaborating closely to ensure that by-catch is properly	3.1, 3.2, 3.3, 3.5, 3.6	3 years	<ul style="list-style-type: none"> • Continue to support RDBES development to ensure by-catch data is included in the RDBES (2020-2022). Annual reporting. • Review bycatch estimations of PETS and rare species by other expert groups (2020-2021). Annual reporting.

	database structures support the implementation of the appropriate estimation procedures.	sampled and estimated in national sampling programmes. To improve collaboration between the two groups, WGBYC members participated in the last WGCATCH meeting to reviewed best practices for sampling protocols for incidental bycatches. The roadmap for ICES bycatch advice describes the science needs, and a path for ICES to strengthen its advice on incidental bycatch. WGCATCH has a important role in the roadmap by developing sampling protocols for estimating PET bycatch risk and by improving data availability and quality (e.g. through monitoring). Further work still to be developed particularly in relation to estimation procedures for rare species and ensure the incidental bycatches are included in the RDBES.			<ul style="list-style-type: none"> • Report on - and support on board sampling practices at national institutes with regard to PETS (2020-2022). Annual reporting. • Report on - and support redesign of national databases with regard to PETS (2020-2022). Annual reporting.
d	Review and collaborate with SCRDB on design-based sampling and estimation.	The RDBES is the practical tool for ICES to ensure the quality and transparency of commercial catch data. WGCATCH has always supported the development of the RDB and now the RDBES. It's knowledge and expertise on the underlying sampling designs are critical to the appropriate use and implementation of the estimation procedures required by the ICES advisory process. The ICES Data Centre and SCRDB have requested 'WGCATCH to continue advising RDBES development and ensuring the development encompasses statistically sound sampling schemes and proper methods of estimation'.	3.2, 3.3, 3.6	Routine ToR	Address specific recommendations from the SCRDB and RDBES associated working groups
e	Collaborate in the advisory process, liaising with assessment groups and benchmarks on commercial catch issues	Commercial catch data is a major input to ICES stock assessments. The accuracy of commercial catch data is highly dependent on the quantity and quality of the sampling and estimation carried by at national level and stock coordination level. WGCATCH is the ICES	3.1, 3.2	Routine ToR	<ul style="list-style-type: none"> • Address specific recommendations from assessment expert groups in relation to commercial catch data to be used/ revised in future benchmarks • Actively seek involvement in a review

		EG that deals with sampling design, estimation and quality of commercial catch data that is provided to the assessment process by the national authorities. It is a key-player in informing on the quality of the time series used and suggesting improvements to sampling and estimation methods. Over 2020-22, WGCATCH will work with the ACOM legacy groups and Fisheries Resources Steering Group (FRSG) to have a more active participation in the assessment and benchmark processes.			and updated of the current benchmark process for data compilation of commercial catch data, so these take resent WGCATCH findings into account
f	Collaborate with other ICES groups dealing with other aspects of catch data (e.g., WGBIOP, WGRFS, PGDATA, WGTIFD, WGBYC), , RCGs (LM) and commercial catch focused external projects.	WGCATCH links with ACOM, SCICOM, EOSG, EGs under EOSG (e.g., PGDATA, WGBIOP, WGRFS) and the ICES secretariat to inform on guidelines on quality and quantity of catch data. WGCATCH further links and obtains information from research projects that address sampling and estimation of commercial catches	3.1, 3.2	Routine ToR	

Summary of the Work Plan

YEAR 1	ToR a)
	<ul style="list-style-type: none"> • Intersessional identify relevant topics contents for commercial sampling guidelines and come up with a framework for having ready-available and updated guidelines. Liase with PGDATA, RDBES core group and ICES data centre in the process and take the work done by former WK's into account • Identify practical issues with sampling of commercial catches, focusing on sampling of unsorted catches (sampling of e.g. small pelagic, fish for reduction, fish pumped into factories and processors), start solving the issues and develop tools for identification of issues. Start to develop the guidelines based on these issues, solutions and tools. • Agree on ToRs for the post stratification WK in 2021 (WKPOST). • Review the R-packages developed for optimization of length and age data (in separate WK: WKBIOPTIM4) and discuss results at the meeting.
	ToR b) <ul style="list-style-type: none"> • Intersessional produce and complete the templates to document sampling effort of biological data on SSF. Extend the 2018 questionnaire to the large scale fisheries (LSF) and refine the risk assessment for transversal data quality methodology

developed in 2018/2019, by including LSF in the risk assessment map and compare SSF and LSF status. Assess the differences between scientific estimate and control data.

- Document sampling effort of biological data on SSF
- Continue to develop best practices guidelines on sampling and census data for SSF for transversal variables and evaluate its implementation
- Following development of RDBES database and making recommendation for the proper integration of SSF data and their specificities into
- Peer review publication on SSF
- Annual chapter in report detailing work progress, next work-plan and deliverables

ToR c)

- Continue to support RDBES developments
- Report and support on board sampling practices at national institutes, including re-designing of national databases
- Initiate review of by-catch estimations of PETS/rare species by other expert groups

ToR d)

- Intersessional liase with PGDATA and ACOM to start the process of giving WGCATCH (as a proxy for commercial catches) a more active role in the assessment and benchmark processes.

ToR e)

- This ToR will be dealt with on a yearly basis by WGCATCH.

ToR f)

- This ToR will be dealt with on a yearly basis by WGCATCH.
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YEAR 2

ToR a)

- Continue updating and developing the guidelines for commercial sampling.
- Identify issues with sampling designs, focusing on sampling of sorted landings on-shore (sampling of e.g. fish for human consumption sold at auctions and other landing sites), start solving issues and develop tools for identifying issues. Start to update and develop guidelines based on the issues, solutions and tools.
- Intersessional identify relevant topics | contents for guidelines on estimation of catch parameters and come up with a framework for having ready-avialable and updated guidelines. Liase with the RDBES core group take the work done by former WK's into account, including WGCATCH's estimation WK's in 2021 and former RDBES WK's
- Review outcomes of WKRATIO and WKPOST. Start producing best practices for estimation

ToR b)

- Develop guidelines for SSF biological sampling
 - Continue to develop best practices guidelines on sampling and census data for SSF transversal variables-and evaluate its implementation
 - Following development of RDBES database and making recommendation for the proper integration of SSF data and their specificities into
 - Evaluate the use of geospatial data (e.g. GPS, AIS) to improve effort estimates and produce guidelines
 - Annual chapter in report detailing work progress, next work-plan and deliverables
 - Identify stocks for case-studies to analyse the length frequency between SSF and LSF
-

 ToR c)

- Continue to support RDBES
- Report on - and support on board sampling practices at national institutes, including re-desing of national databases
- Continue review of by-catch estimations of PETS species by other expert groups
- Intersessional liaison with WGBYC and draft ToRs for a WK that addresses estimation of rare things (e.g. species, events) (WKRARE, 2022) in the following year. Taking the review of present methods into account. Approve proposed ToR's at the meeting

ToR d)

- Intersessional liaise with PGDATA and ACOM to start a process of giving WGCATCH (as a proxy for commercial catches) a more active role in the assessment and benchmark processes

ToR e)

- This ToR will be dealt with on a yearly basis by WGCATCH.

ToR f)

- This ToR will be dealt with on a yearly basis by WGCATCH.
-

YEAR 3

ToR a)

- Continue updating and developing the guidelines for commercial sampling.
- Identify issues with sampling designs, focusing on sampling of sorted landings at-sea (e.g. observers programmes at-sea targeting fish for human consumption), start solving issues and develop tools for identifying issues. Update and develop guidelines based on the issues, solutions and tools.
- Continue updating and developing the guidelines for estimation, taking the work from WKRARE (2022) into account

ToR b)

- Intersessionally produce and issue an informal data call for provision of length frequency data, from the stocks identified in previous meetings
- Analysis on length frequency data from SSF and LSF and evaluate the relevance and impact of SSF data for the stock assessment
- Develop guidelines for SSF biological sampling
- Evaluate the use of geospatial data (e.g. GPS, AIS) to improve effort estimates and produce guidelines
- Continue to develop best practices guidelines on sampling and census data for SSF transversal variables-and evaluate its implementation
- Following development of RDBES database and making recommendation for the proper integration of SSF data and their specificities into
- Annual chapter in report detailing work progress, next work-plan and deliverables

ToR c)

- Continue to support RDBES
 - Report on - and support on board sampling practices at national institutes, including re-desing of national databases
 - Review outcomes of WKRARE and update guidelines | best practice (from ToR a) in
-

accordance

ToR d)

- Intersessional liase with PGDATA and ACOM to start the process of giving WGCATCH (as a proxy for commercial catches) a more active role in the assessment and benchmark processes.

ToR e)

- This ToR will be dealt with on a yearly basis by WGCATCH.

ToR f)

- This ToR will be dealt with on a yearly basis by WGCATCH.
-

Supporting information

Priority	WGCATCH supports the development and quality assurance of regional and national catch sampling schemes and estimation procedures that can provide reliable quality input data to stock assessment and advice, while making the most efficient use of sampling resources. As catch data are the main input data for most stock assessments and mixed fisheries modelling and an essential component of analysis of ecosystem effects of fisheries, especially with regard to the application of the Precautionary Approach, these activities are considered to have a high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resources required to undertake additional activities in the framework of this group is negligible. WGCATCH builds extensively on experiences gained within PGCCDBS, WKACCU, WKPRESISE, WKMERGE, WKPICS, SGPIDS, WGRFS and previous WGCATCH work in the period 2014-2019. European countries are encouraged to provide the WG with any requested documentation of their sampling programmes and manuals, estimation methods, quality assurance procedures, for review and feedback by the WG, and to ensure that their national members of WGCATCH have sufficient resources to conduct the necessary intersessional work to address the ToRs. The attendance of 1-2 top-level experts in the area of statistically sound sampling and estimation will be secured to review the quality of final outputs of WGCATCH.
Participants	The Group is normally attended by some 30–40 participants, including members, and chair-invited 1-2 external experts.
Secretariat facilities	None.
Financial	Member States may fund this through their EMFF programme. ICES may cover the attendance of reviewers.
Linkages to ACOM and group under ACOM	WGCATCH falls under the joint ACOM/SCICOM steering group on integrated ecosystem observation and monitoring (EOSG), and supports the ICES advisory process by promoting improvements in quality of fishery data underpinning stock-based and mixed fishery assessments, ecosystem indicators related to fishery affects, and in developing data quality indicators and quality reports for use by assessment EGs and benchmark assessments.

Linkages to other committees or groups	There is a very close working relationship with all catch-related EGs and end-users including WGBIOP (in relation to collection of stock-based biological variables from fishery catches), PGDATA (in relation to data requirements of stock assessment EGs and benchmark assessment groups, optimization of catch sampling programmes and communication of quality information on commercial catch data), WGBYC (in relation to the sampling design and estimation of PETS bycatch and other incidental by-catches), RCM/RCGs and the Liaison Meeting (e.g., in relation to data requirements and regional sampling designs), the SC-RDBES and the ICES Data Centre (in relation to RDBES issues), STECF EWGs dealing with EU-MAP and other legislative changes that impact catch sampling and JRC (in relation to data provision from commercial catch sampling programmes).
Linkages to other organizations	The work of this group is closely aligned with similar work in FAO, GFCM, CECAF, NAFO/NEAFC and in the Census of Marine Life Programme.

Workshop on Operational Implementation of Stomach Sampling (WKOISS)

2019/WK/EOSG11 The Workshop on Operational Implementation of Stomach Sampling (WKOISS), chaired by Pierre Cresson*, France and Maria Valls*, Spain, will be established and will meet in ~~Cagliari, Italy, 25–29 May 2020~~ to:

This meeting is postponed until 2021 due to the outbreak of corona virus

- a) Review the outcomes of two stomach content data collection pilot studies established under WKSTCON (*Merluccius merluccius* for Mediterranean and *Psetta maxima* for Black sea); ([Science Plan codes](#): 1.7);
- b) Determine the most appropriate method / indices to derive from stomach content studies focusing on gaps in currently available information use in ecosystem modelling approaches.; ([Science Plan codes](#): 5.2);
- c) Characterize and prioritise the influence of ontogeny, space and time on the variability in diet composition and propose sampling plans that account for this variability in the sampling design to reduce uncertainty in ecosystem model outputs; ([Science Plan codes](#): 1.7; 3.2; 3.3);
- d) Building on WKBECOSS and WGSAM results, develop standardized selection methods to determine species and species grouping to be identified in stomach contents considering species distributions within and between ecosystems.; ([Science Plan codes](#): 1.9; 3.1);
- e) Evaluate stomach content database formats (e.g. ICES, DAPSTOM as listed in WKBECOSS) for their regional appropriateness for ecosystem modelling purposes; ([Science Plan codes](#): 3.1);
- f) Describe options for intercalibration approaches that would aid the suitable integration of data across partners at the regional scale; ([Science Plan codes](#): 3.1; 3.4; 6.3);

This workshop has to be considered as a follow up of the previous WKSTCON workshop held in Palma de Mallorca, Spain, in April 2018 and WKBECOSS, held in Santander, Spain, in September 2019.

WKOISS will report by ~~22 June 2020~~ for the attention of the DSTSG.

Supporting information

Priority	Integrated vision of marine ecosystems functioning is now considered as a crucial research pathway and also as a need to better manage exploited systems. Stomach content is a powerful tool to explore fundamental questions and manage marine systems, notably when large datasets, covering large geographical areas, can be produced. After the Workshop on Better Coordinated Stomach Sampling (WKBECOSS) in 2019, this meeting on the operational aspects for stomach contents is needed and is urgently to begin to organize the sampling of new biological data from 2020. Therefore, these activities are considered to have a high priority.
Scientific justification	Data resulting from stomach content analyses are acknowledged as powerful, as they can provide information about predator-prey relationships at very fine taxonomic scale. They are also crucial for ecosystemic models, as dietary matrices are key input data. To ensure a homogeneous data set with suitable spatio-temporal coverage and make effective and efficient use of available resources, coordination of stomach sampling studies is essential. Stomach sampling is necessary to ensure that multi-species and ecosystem models remain relevant and to support analyses of the structure and functioning of food webs. This work could benefit the new research on the food web from the ecosystem models.
Resource requirements	None.
Participants	In view of its relevance to the ICES quality assurance, the Workshop is expected to attract interest from Mediterranean and Atlantic areas, ICES and GFCM. Participants will be experts from leading labs and universities working in stomach contents. The workshop will work closely with the newly formed RCG Intersessional subgroup on Stomach Sampling.
Secretariat facilities	None.
Financial	None.
Linkages to advisory committees	ACOM
Linkages to other committees or groups	WGBIOP, SCICOM, RCGs, WGSAM
Linkages to other organizations	GFCM

Group on Governance of the Regional Database & Estimation System (WGRDBESGOV)

2020/FT/DSTSG01 A Working Group on Governance of the Regional Database & Estimation System (WGRDBESGOV), chaired by David Currie, Ireland and Katja Ringdahl, Sweden, will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2020	1 st – 3 rd December	Online	Interim report by 1 st Feb 2021 to DSTSG	
Year 2021	TBC	TBC	Interim report by TBC to DSTSG	
Year 2022	TBC	TBC	Final report by TBC to DSTSG	

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	<p>Review the status of the development of the new commercial fisheries Regional Database & Estimation System (RDBES) and its project plan for implementation, including the funding of the outstanding development. Adjust the project plan as required. Oversee and advise on the interpretation and prioritisation of recommendations for the RDBES development. Identify user guidance and training required for RDBES users.</p>	<p>The commercial fisheries Regional Database & Estimation System (RDBES) will be extensively used by ICES member states, the EU Regional Coordination Groups, and ICES expert groups to store detailed commercial fisheries sample data. The RDBES is also intended to replace the current ICES Inter-Catch system so will also function as a database and estimation system for ICES Fisheries Advice. The RDBES is therefore a key development to support the ICES advisory process.</p>	3.1, 3.2, 3.3	3 years	<p>An up-to-date roadmap for the Regional Database & Estimation System (RDBES) developments describing when functionality will be available. The RDBES project plan is monitored and fulfilled. Recommendations for relevant workshops are made.</p>
b	<p>Provide a platform for user feedback to the Regional Database & Estimation System (RDBES). Appropriate actions to be taken with assigned responsibilities and resource requirements will be listed and prioritised. Ensure that any required sub-groups (including the existing “Core group”) are created and function effectively whilst needed.</p>	<p>The Regional Database & Estimation System (RDBES) should develop to meet the requirements of a broad range of users and thus needs to be responsive to user feedback.</p>	3.1, 3.2, 3.3	3 years / generic ToR	<p>A public Regional Database & Estimation System (RDBES) GitHub site is maintained - this makes the data model available, and provides a platform for users to raise and discuss issues. Sub-groups (such as the existing “Core group”) complete any required tasks (e.g. refining specifications and answering user queries) Recommendations from users are responded to.</p>
c	<p>Oversee and summarize how the existing commercial fisheries Regional Database (RDB) and the new Regional Database & Estimation System (RDBES) are used in the EU Regional Coordination Groups (RCGs), and ICES expert groups, along with</p>	<p>The aims of the new Regional Database & Estimation System (RDBES) include increasing the awareness of fisheries data collected by the users of the RDBES and the overall usage of these data. Therefor it is important to monitor how different users are using the data.</p>	3.1, 3.2, 3.3	3 years / generic ToR	<p>Summaries of the existing commercial fisheries Regional Database (RDB) and the new Regional Database & Estimation System (RDBES) data calls are published annually. Summaries of the use of RDB/RDBES data</p>

	any other uses. Where possible, share any outputs with other interested groups and users.				are published annually.
d	Review the data governance framework of the commercial fisheries Regional Database (RDB) and Regional Database & Estimation System (RDBES)	The Regional Database & Estimation System (RDBES) is intended to host data from multiple ICES member countries and EU member states. Different users will have different permissions (depending on their needs). Data governance of the RDBES is therefore a key topic to ensure that it can function in a secure and efficient manner.	3.1, 3.2, 3.3	3 years / generic ToR	Appropriate Regional Database (RDB) and Regional Database & Estimation System (RDBES) data governance policies are agreed and implemented

Summary of the Work Plan

An annual meeting will be held, as well as any inter-sessional work required, to work on the ToRs.

ToR a)

- Review the Regional Database & Estimation System (RDBES) project plan.
- Review feedback summaries from RDBES workshops (such as WKRDB-POP2, WKRDB-EST2, WKRDB-RAISETAF)
- Review results and feedback from the RDBES test data call.
- Adjust the project plan as required.

ToR b)

- Information on the public RDBES GitHub (<https://github.com/ices-tools-dev/RDBES>) site is kept up-to-date
- Issues raised on the GitHub site are responded to in a timely manner
- The “Core group” (and any other required sub-groups) meet as required to work effectively.

ToR c)

- Review and summarise responses to the RDB/RDBES data calls
- Determine which groups have used RDB/RDBES data during the year and, where possible, view any of their outputs based on RDB/RDBES data.
- Review any feedback arising from those groups.
- Ensure all data governance policies are being adhered to during data use.
- Where possible, share outputs and code from the different users of RDB/RDBES data

ToR d)

- Review the RDB/RDBES data policy and draft amendments if required
- Review the “Conditions for detailed RDBES data use” document
- Make any further changes required to the RDB/RDBES data governance policies and procedures
- Ensure data governance will be suitable for using RDBES data within ICES stock assessment

Supporting information

Priority	The activities of this group will ensure the development of the commercial fisheries Regional Database and Estimation System, RDBES, whilst still maintaining the existing Regional Database (RDB) during the development period. The RDBES when it is implemented works as a database for the Baltic Sea, North Sea & Eastern Arctic, North Atlantic and Long Distance Fisheries Regional Coordination Groups (RCGs). The RDBES is also intended to replace the current ICES InterCatch system so it will also function as a database and estimation system for ICES Fisheries Advice. Consequently, these activities are considered to have a high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resources required to undertake additional activities in the framework of this group are negligible. Countries are encouraged to ensure that their national members have sufficient resources to conduct the necessary intersessional work to address the ToRs. For EU Member States, work within this WG can be funded under the Data Collection Framework (DCF)/European Maritime, Fisheries and Aquaculture Fund (EMFAF).
Participants	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	SharePoint and meeting room requirement.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	There are no direct linkages with ACOM, but most of the stock assessment Working Groups will be impacted by the development of the RDBES.
Linkages to other committees or groups	There is a strong thematic link with groups including WGCATCH and WGBIOP. Since the RDBES will interact with the ICES Transparent Assessment Framework (TAF) there is also a close link with WGTAFGOV. It will also be relevant to other data governance groups under the new Data Science and Technology Steering Group (DSTSG).
Linkages to other organizations	The RDBES will support the work of the EU Regional Coordination Groups (RCGs).

Workshop on Age estimation of European anchovy (*Engraulis encrasicolus*) (WKARA3)

2020/WK/DSTSG02 A Workshop on Age estimation of European anchovy (*Engraulis encrasicolus*) (WKARA3), chaired by Gualtiero Basilone*, Italy, will be established and will meet in Capo Granitola, Sicily, Italy, in November 2021 to:

- a) Review information on anchovy age determination, otolith exchanges, workshops and validation works done so far ([Science Plan codes](#): 5.1, 5.2);
- b) Analyse growth increment patterns in anchovy otoliths and to improve (if necessary) the guidelines for their interpretation ([Science Plan codes](#): 5.1, 5.2);
- c) Analyse the results of the exchanges carried out in 2018 and the potential source of discrepancies, according to the literature review and new validation studies carried out ([Science Plan codes](#): 5.1, 5.2);
- d) Increase existing reference collections of agreed aged otoliths by stocks and areas ([Science Plan codes](#): 5.1, 5.2);

- e) Address the generic ToRs adopted for workshops on age calibration (see [WGBIOP Guidelines for Workshops on Age Calibration](#)) (Science Plan codes: 5.1, 5.2).

WKARA3 will report to the attention of WGBIOP, SCICOM and ACOM.

Supporting information

Priority	Age determination is an essential feature in fish stock assessment to estimate the rates of mortality and growth. In order to arrive at appropriate management advice ageing procedures must be reliable. Age data are provided by different laboratories and countries using internationally agreed ageing criteria. It is necessary to continue to clarify the guideline of age interpretation. Therefore, otolith exchanges should be carried out on a regular basis, and if serious problems exist age reading workshops should be organised to solve these problems.
Scientific justification	An otolith exchange was made in 2018 and at WKARA3 results from this otolith exchange will be presented and discussed, in view of the poor precision of age determination resulting from the exchange programme. Presentation of new validation or corroboration studies Involvement of others research groups also from different Mediterranean Sea areas (i.e non EU and non EU countries with shared resources).
Resource requirements	No specific resource requirements beyond the need for members to prepare for and participate in the meeting.
Participants	In view of its relevance to the ICES quality assurance, the Workshop is expected to attract wide interest from both Mediterranean and Atlantic areas, ICES and the General Fisheries Commission for the Mediterranean (GFCM). The Workshop tries to bring together international experts on anchovy age reading and fish growth and scientists involved in stock assessment to assess the accuracy and precision of the age determination.
Secretariat facilities	None.
Financial	
Linkages to advisory committees	ACOM , GFCM
Linkages to other committees or groups	SCICOM, WGBIOP, WGCOMEDA and WGHANSA
Linkages to other organizations	Working Group on Stock Assessment of Small Pelagic Species (WGSASP) from GFCM

Working Group on the Governance of Quality Management of Data and Advice (WGQuality)

2020/FT/DSTSG03 A Working Group on the Governance of Quality Management of Data and Advice (WGQuality), chaired by David Currie*, Ireland, will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2021	19-22 January	Web conference	Interim report by 1 st March 2021 to DSTSG	
Year 2022	TBC	TBC	Interim report by Date Month May to DSTSG	
Year 2023	TBC	TBC	Final report by Date Month May to DSTSG	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Analyse existing ICES quality management processes within advice production and evaluate their coherence with the objectives of the ICES advisory plan. In particular highlight any gaps and overlaps between different processes.	The concept of “quality” is cross-cutting and should be managed throughout a process. The ICES advisory plan highlights the first priority area for development is “Assuring Quality” - it states that quality assurance “encompasses the entire process from data collection to the publication of objective and independent advice”.	3.1, 3.2, 3.3	3 years	An evaluation of the existing quality processes and procedures within ICES.
b	Specify a fully operational ICES advisory quality management system that is in line with the scope and direction in the advice plan.	There is a recognition within ICES of the need for an end-to-end quality management system (QMS) to encompass best practice in data management, data integration, and translation into advice. A QMS is defined as “...a formalized system that documents processes, procedures, and responsibilities for achieving quality policies and objectives”.	3.1, 3.2, 3.3	3 years	A draft ICES quality manual which will describe the overall approach to assuring the quality of assessment and advice within ICES. This will cover the quality assurance process from data collection to advice publication.
c	Create and implement an internal communication plan to explain the	There is a large amount of activity in the ICES world focussing on data needs for assessment and advice. One of the major	3.1, 3.2, 3.3	3 years	Quality assurance communication plan for the ICES network.

	quality management system, ensure effective feedback mechanisms to identify needed improvements and highlight existing good practice.	benefits of having a large number of expert groups, organisations, and individuals participating in this process is the high level of innovation displayed. However, the downsides of this can include a lack of knowledge about what other work is being done by other people and a lack of coordination in harnessing this work.			
d	Use the quality management system to evaluate current activities.	Identify gaps and create a plan to fill them. Prioritise issues, identify unnecessary duplication of activities, and propose remedies.	3.1, 3.2, 3.3	3 years	
e	Operationalise the quality tools and processes that were proposed during the previous 3-year cycle of PGDATA.	PGDATA has previously proposed a number of interesting tools and processes to improve the data informing the assessment and advice process. With the new RDBES/TAF system becoming fully operational over this next work cycle, this is an ideal time to embed these within the workflow. To this end, the next 3-year cycle should also ensure that these ideas are operationalised.	3.1, 3.2, 3.3	3 years	The finalised “Series of ICES Sampling Protocols” template proposed by PGDATA for fisheries dependent data. Documents (based on the temple) describing commercial sampling programs have been created by countries. The process to link the completed documents to data submitted to the commercial fisheries Regional Database & Estimation System (RDBES) is agreed. The procedure to make these documents available to stock assessment groups via the RDBES and Transparent Assessment Framework (TAF) has been agreed and tested. Structure and maintenance of PGCCDBS repository is agreed RDBES/TAF script and tools repository

Summary of the Work Plan

YEAR 1	ToR a) and b) <ul style="list-style-type: none"> • Collate existing policies that relate to the quality of ICES advice and identify any gaps. • Agree on a format for the ICES quality manual and which ICES publication type it fits best • Create a first draft an ICES quality manual for the advisory process – the purpose of the manual is to document the overall approach to quality management of advice within ICES. The working group will not be looking to invent multiple new procedures but will instead concentrate on compiling and collating the existing procedures into a coherent whole. • Identify the types of generic processes within ICES that contribute to advice outputs.
	ToR c) <ul style="list-style-type: none"> • Outline a communication plan for the 3-year cycle of the working group.

	<ul style="list-style-type: none"> • Identify key stakeholders that should be prioritised • Identify the key messages that should be communicated
ToR d)	<ul style="list-style-type: none"> • Limited activity expected in year 1
ToR e)	<ul style="list-style-type: none"> • Identify if are all data collected and used for advice purposes are covered by an identified sampling protocol (e.g. the Series of ICES Sampling protocols used for surveys, and the PGDATA proposed “Series of ICES Sampling Protocols” for fisheries dependent data) • Finalise the “Series of ICES Sampling Protocols” template for fisheries dependent data and encourage countries to start using it. • Investigate the feasibility of a “species identification” app and other ideas produced by PGDATA • Review status of the PGCCDBS (Data Quality Assurance) repository and agree on the way forward. • Review draft ICES advice and RDBES data calls and give feedback
YEAR 2	<p>ToR a) and b)</p> <ul style="list-style-type: none"> • Revise draft ICES quality manual in line with feedback • Define what documentation is needed for the processes that contribute to ICES advice (such as process flows, standard operating procedures, guidelines, and manuals). Propose tools such as standard templates when required • Propose who will need to complete the documentation e.g. a benchmark assessment group. <p>ToR c)</p> <ul style="list-style-type: none"> • Review and refine communication plan • Identify key targets for year 2 and year 3, alongside the stakeholders identified for Year 1 <p>ToR d)</p> <ul style="list-style-type: none"> • Use the quality management system described in the quality manual to identify gaps in processes • Begin identifying new or revised tools or processes that can fill the identified gaps. Tools could refer to code but might also could be “soft” items such as decision support flow-charts. The group would not intend to create all the identified tools ourselves. <p>ToR e)</p> <ul style="list-style-type: none"> • Start to create a collection of useful data quality, scripts, graphs and function that can be used within the RDBES/TAF. Design processes that will allow people to contribute to this work. Agree how this work fits with the PGCCDBS (Data Quality Assurance) repository and how it will be maintained. • Review draft ICES advice and RDBES data calls and give feedback
YEAR 3	<p>ToR a) and b)</p> <ul style="list-style-type: none"> • Revise draft ICES quality manual in line with feedback • Track and review the documentation. <p>ToR c)</p> <ul style="list-style-type: none"> • Refine year 3 of the communication plan and implement it <p>ToR d)</p> <ul style="list-style-type: none"> • Use the quality management system described in the quality manual to identify gaps in processes • Continue identifying new or revised tools or processes that can fill the identified gaps <p>ToR e)</p> <ul style="list-style-type: none"> • Promote the data quality and RDBES/TAF repository/ies. • Review draft ICES advice and RDBES data calls and give feedback

Supporting information

Priority	Improving quality assurance processes is a key priority for ICES and is a priority area of the ICES Advice Plan – the work of this group is thus considered as a high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resources required to undertake additional activities in the framework of this group is negligible. WGQuality builds extensively on experiences gained within PGDATA and PGCCDBS. Countries are encouraged to ensure that their national members have sufficient resources to conduct the necessary intersessional work to address the ToRs. For EU Member States, work within this WG can be funded under the Data Collection Framework (DCF)/European Maritime, Fisheries and Aquaculture Fund (EMFAF).
Participants	The Group is normally attended by some 20–25 members and guests. The participants at WGQuality should represent the entire process from data collection (fisheries dependent and independent data) to the publication of objective and independent advice.
Secretariat facilities	SharePoint and meeting room requirement.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	There will be strong linkage with ACOM
Linkages to other committees or groups	The work within this group is very relevant to the groups within the FRSG and forthcoming DSTSG (particularly WGCATCH, WGBIOP and WGRDBESGOV). This work will also be relevant to groups within the IEASG, in particular since a wide variety of data sources will be contributing to the outputs of those groups.
Linkages to other organizations	There is a natural link to similar issues of quality assurance in the EU Regional Coordination Groups.

Workshop on Estimation of Commercial Catches I – Ratio estimators (WKRATIO)

2020/WK/DSTSG04 The **Workshop on Estimation of Commercial Catches I – Ratio estimators (WKRATIO)** chaired by Liz Clarke* (UK-Scotland) and Laurent Dubroca* (France), will meet in online, 31 May – 4 June 2021 to:

- a) Develop and test R-scripts for statistically-based ratio estimators for length and age for landings and discards that follow the sampling design, using RDBES exchange format. ([Science Plan Codes: 3.3](#))

WKRATIO will report by 18 June 2021 for the attention of the Data Science and Technology Steering Group, ACOM and SCICOM.

Supporting Information

Priority	This workshop is considered to have a high priority to support the development of the RDBES, by developing improved ratio estimation methods that increase the transparency and the quality of the estimates used in the stock assessment groups, and that will be used as estimation routines in the RDBES.
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Scientific justification	Currently, most countries use ratio estimators for their national estimation of commercial catch data. Recent discussions at WGCATCH and other EGs have increasingly highlighted that estimation techniques currently used by many countries to process commercial catch data may not be the most up-to-date and/or ignore sampling design and/or are far from transparent and standardized and involve significant levels of ad-hoc decisions. One of the focus for the next 3 year work plan of WGCATCH is to produce best practice guidelines for choosing methods and variables used to analyse commercial sampling data (algorithms, tools for analysing the appropriateness of using the specific estimator: Ratio estimators and estimation of variance). The outcomes of this workshop are important for WGCATCH to evaluate prior to their incorporation as regular estimation routines in RBDES.
Resource requirements	Participants are requested to document sampling designs and estimation methods ahead of the meeting; and to bring to the meeting commercial catch data: landings and sampling catch data stored in the latest RDBES exchange format. IT resources required for international virtual meeting,
Participants	The target attendance are participants from ICES member countries involved in providing commercial catch data to the stock assessment groups and use ratio estimators for their discard and biological estimates. Participants should have prior experience in statistically sound sampling and/or estimation and/or r-scripting. 10–20 participants are expected to attend.
Secretariat facilities	ICES will provide SharePoint access and ICES Secretariat support.
Financial	EU Member States may fund this through their EMFF programme
Linkages to advisory committees	ACOM, SCICOM, DSTSG
Linkages to other committees or groups	WGCATCH, WGQUALITY, WGRDBESGOV and associated RDBES group.
Linkages to other organizations	Regional Coordination Groups, General Fisheries Commission for the Mediterranean

Third Workshop on Populating the RDBES data model (WKRDB-POP3)

2020/WK/DSTSG05 The **Third Workshop on Populating the RDBES data model (WKRDB-POP3)** chaired by David Currie, Ireland and Edvin Fuglebakk, Norway will be held online from 14th - 18th June 2021 to:

- a. Describe and explain the RDBES data model to national data submitters using worked examples ([Science Plan Codes](#): 3.1, 3.2, 3.3).
- b. Provide hands-on guidance and assistance to national data submitters to write working data extraction scripts to convert national data formats to the RDBES data format ([Science Plan Codes](#): 3.1, 3.2, 3.3).
- c. Identify and document any problems in converting national data formats to the RDBES format ([Science Plan Codes](#): 3.1, 3.2, 3.3).
- d. Facilitate wider participation in testing of the RDBES data submission system ([Science Plan Codes](#): 3.1, 3.2, 3.3).

WKRDB-POP3 will report by 31 August 2021 for the attention of the Data Science and Technology Steering Group, ACOM and SCICOM.

Supporting information

Priority	<p>The activities of this workshop will promote the development of a Regional Database and Estimation System, RDBES. This workshop will help countries to correctly convert their national data formats to the RDBES format. The RDBES when it is implemented works as a database for the Baltic Sea, North Sea & Eastern Arctic, North Atlantic and Long Distance Fisheries Regional Coordination Groups (RCGs). The RDBES will also function as a database and estimation system for ICES Fisheries Advice. The development will concentrate on harmonisation, quality assuring, documentation, approved estimation methods and transparency. Consequently, these activities are considered to have a very high priority.</p> <p>ICES will issue a data call in 2021 for 2020 samples for selected stocks, and 2020 landings and effort data for all stocks, in the new RDBES format. The ideal conclusion is that at the end of this workshop each person attending has developed working scripts to extract the data that will be requested by the RDBES data call</p>
Scientific justification	<p>The RDBES will be extensively used by the RCGs and ICES both to store detailed fisheries sample data and use it for estimation - therefore it is essential that national data submitters are familiar with the RDBES format and confident in correctly converting their national data to this format. The WKRDB-POP in 2019 and WKRDB-POP2 in 2020 started this process but it is necessary to hold a third workshop because (i) there have been minor changes to the RDBES data model since the last workshop, and (ii) not all institutes submitting data was able to submit data to the 2020 test data call, and support for further work on data conversion routines are indicated.</p> <p>ToR a) – Describe and explain the RDBES data model to national data submitters using worked examples</p> <p>The RDBES data format will be explained using its documentation, and a number of worked examples. These worked examples will play an important role in illustrating the types of decisions that data submitters will need to make.</p>

ToR b) – Provide hands-on guidance and assistance to national data submitters to write working data extraction scripts to convert national data formats to the RDBES data format

This is the most important part of the workshop and will occupy the majority of the workshop’s time - it will entail the RDBES Core Group providing practical online assistance to the attendees. The workshop attendees must be familiar with their own national sampling programme designs, and must have made preparations necessary to provide real data sets of their national samples to the workshop. The Core Group will then help them to convert their data to the new RDBES format. The more work that attendees have done in trying to populate the RDBES format with their own data before the workshop the more value they will gain from this work.

When new questions are identified and resolved they can be added to the RDBES “Frequently Asked Questions” so that other people can benefit from the answers.

ToR c) – Identify and document any problems in converting national data formats to the RDBES format problems

If it is not clear how particular data should be converted to the RDBES format then this will be recorded for future discussion and resolution.

ToR d) - Encourage national data submitters to join the RDBES testing group

WKRDB-POP 2 participants contributed significantly to testing the RDBES data submission system in the interim between that workshop and the deadline for the test-data call. This was key in addressing many specific software issues, and it would be desirable to expand this testing group to a wider selection of national data-submitters. Rigorous and in-depth testing is vital to ensure RDBES can meet its deliverables and to ensure the system and all supporting facilities are functioning as envisioned and designed.

Resource requirements	Members of the “RDBES Core Group” will be requested to participate as hands-on instructors/demonstrators. The ICES Data Centre will provide technical support for RDBES data uploading.
Participants	~60 people
Secretariat facilities	SharePoint, Online meeting room support
Financial	No financial implications.
Linkages to advisory committees	There are no direct linkages with the advisory committees, but most of the stock assessment Working Groups will be impacted by the development of the RDBES.
Linkages to other committees or groups	There is a link to WGCATCH, WGQUALITY and WGBYC.
Linkages to other organizations	The RDBES will support the work done by the RCGs under the European Commission, EC. The aim is also allow the RDBES to support the countries in providing data for the data calls under the EC.

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

2020/WK/DSTSG06 The **Workshop on use of Ageing and Maturity Staging Error Matrices in Stock Assessment (WKAMEMSA)**, chaired by Alfonso Pérez-Rodríguez (IMR-Norway) and Karen Bekaert (ILVO-Belgium), will be established and will meet online, 21-23 September 2021, to:

- a) Revision of existing research on the effects of ageing and maturity staging error in stock assessment, including examples where incorporation of age/maturity error has been tested on the stock assessment output ([Science Plan codes: 5.1 & 5.2](#)).
- b) Review the existing SmartDots data output, the analysis applied and the report templates. Consider the current protocols for otolith and gonad selection outlined in the WGBIOP Guidelines for Exchanges and Workshops on Age Reading and Maturity Staging. Outline future work depending on the outcomes of this workshop ([Science Plan codes: 4.1 & 4.3](#)).
- c) Examine the potential to incorporate age and maturity error information into the main assessment models currently used within ICES. Identify the data input and modifications in the model structures that would be required, as well as the steps needed to incorporate those changes into the assessment platforms (e.g. stockassessment.org) ([Science Plan codes: 5.1 & 5.2](#)).
- d) Identify potential stock level case studies where evidence of important error exists in the determination of age, maturity or both, and where evaluation models with the potential capacity to incorporate this information can be developed ([Science Plan codes: 4.1, 4.3, 5.1 & 5.2](#)).
- e) Consider the future integration with TAF and feedback to TAFGOV on the workshop outcome ([Science Plan codes: 6.1](#)).

WKAMEMSA will report by 4 November 2021 for the attention of ACOM/SCICOM.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the use of ageing and maturity staging error information in stock assessment and the effect of this error in stock assessment uncertainty. Consequently, these activities are considered to have a very high priority.
Scientific justification	<p>Term of reference a)</p> <p>The problem of error in age determination and maturity staging, and their impact in stock assessment has been treated before in previous studies and the subject would benefit from a review of progress and an evaluation of the results obtained. Having this review would likely help to identify the directions that should be followed.</p> <p>Term of reference b)</p> <p>As part of the process to develop an approach to consider ageing and maturity staging error into stock assessment it is necessary to review the protocol for otolith and gonads selection in the exchange events available in Smartdots, as well as the statistical analysis conducted and the way the error matrices are calculated. This is a necessary step to ensure that the quality of the statistical information, and the structure of the report output is suitable and contains useful information for the relevant stock assessment models.</p> <p>Term of reference c)</p> <p>This ToR is intended to identify the models that have potential capacity to incorporate age and maturity error information. The work that will be needed to do it, and the steps</p>

required to integrate those model modifications in the assessment platforms will be defined. The output of this ToR, in combination with ToR b, will identify the necessary modifications needed in the WGBIOP protocol and the SmartDots data analysis to support the assessment model requirements.

Term of reference d)

After the protocols to collect and analyze the data, and the models that can incorporate this information have been identified, it is necessary to review the ICES stocks that could be considered as candidate case studies to continue developing the incorporation of age error information in stock assessment.

Term of reference e)

This ToRs is intended to integrate with the ICES transparency and quality frameworks. Although it is not expected that in the early steps this will be a crucial element, considering it from the early steps might be useful to accommodate adequately all modifications in the assessment models.

Resource requirements	The research programmes which provide the main input to this group are already underway. The additional resources required to undertake additional activities in the framework of this group is negligible. There are no additional resource requirements for the workshop beyond the secretariat support for group organisation.
Participants	The Group will be attended by approximately 12 participants.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	There are no obvious direct linkages with the advisory committees.
Linkages to other committees or groups	There is a very close working relationship with WGBIOP, WGSMAART and it is expected to be relevant for the WGs in charge of the assessment of the case study stocks. Depending on the progress, the interest of the output might be extensive to all the WGs that use the assessment models that end up incorporating the age error information.
Linkages to other organizations	No linkages to other organizations

Workshop on Age reading of Sea bass (*Dicentrarchus labrax*) 2 (WKARDL2)

To be approved by ACOM/SCICOM (pending)

2020/WK/DSTSGXX

Working Group on Biological Parameters (WGBIOP)

To be submitted (pending)

2020/FT/DSTSGXX

Resolutions approved in 2018

Working Group on SmartDots Governance (WGSMART)

2018/MA2/EOSG01 The Working Group on SmartDots Governance² (WGSMART), co-chaired by Julie Coad Davies* (Denmark) and Jane Aanestad Godiksen* (Norway), will meet intersessionally, 4 times per year via WebEx and may meet physically once per year, to work on ToRs and generate deliverables as listed in the Table below.

	<u>WEBEX</u> Meeting dates	Meeting dates and Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	1) 7 February 2) 25 April 3) 12 September 4) 14 November	11-12 October Lisbon, Portugal (Venue as WGBIOP)	Interim report by 8 th November to EOSG	
Year 2020	1) 14 January 2) 21 April 3) 12 May 4) 23 October	8 September and 26 November (Online meetings)	E-evaluation	Agreed upon at WGSMART October 2019 meeting that WGSMART will meet before WGBIOP 2020 and proposes that the first day of WGBIOP is dedicated to overlapping work of WGSMART and WGBIOP
Year 2021	1) 11 January 2) 11 May 3) 2 September 4) 28 October	24-25 November Copenhagen, Denmark (ICES HQ)	Final report by 6 January 2022 to DSTSG	If the approach taken in 2020 works then this will be followed in 2021

WGSMART will report on its activities by the March SCICOM meeting the following year to DSTSG and DIG.

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Oversee and advise on the interpretation and prioritisation of recommendations and requests addressed to WGSMART	SmartDots is an operational tool that aims to improve the overall quality of age data delivered to assessment EG's. The tool is now operational and an integral part of the ICES QAQC for aging many fish species for which ICES provides advice, procedure largely under the guidance of WGBIOP. However	3.1, 4.1	3 years/ Generic ToR	A prioritised list of SmartDots related expert group recommendations with a proposed annual work plan to address concerns and implement improvements to SmartDots.

² <http://ices.dk/marine-data/tools/Pages/smartdots.aspx>

		maintenance and future development of the platform are beyond the scope of the scientific WG's and WK's.			
b	Provide a platform for end user feedback to the SmartDots system. User feedback will be requested from the end users via the GitHub site, exchange/workshop reports, EG'S and committes. Feedback will be compiled by WGSMAART and appropriate actions to be taken with assigned responsibilities will be listed and prioritised.	SmartDots will be further developed to meet the requirements of a broad range of end users and thus needs to be responsive to user feedback. This feedback system needs to be independent of WGBIOP as a greater responsiveness (more than one meeting a year) is required to manage the system effectively.	3.1, 4.1	3 years/Generic ToR	
c	Elaborate a forward plan for the sustainability of SmartDots as a platform	To achieve a continuous quality, SmartDots needs to be developed in line with end users needs. This development requires an input of resources; knowledge, expertise, manpower and funding over a period of time which extends beyond the initial phase. A workplan with clear objectives and milestones can only be successfully implemented when the availability of such resources is clear.	4.4, 3.6	3 years/Generic ToR	A workplan outlining what resources are required for development, support, training and dissemination of relevant information. An estimated budget including identified funding resources.
d	Oversee development of user guidance and training in SmartDots	As SmartDots develops overtime a range of users will require various levels of training including step by step user manuals, tutorials and possibly workshops. Documentation of guidelines and procedures in line with WGBIOP will also be necessary. Outreach activities will be required.	3.1, 4.1	3 years/Generic ToR	Annually updated training documentation. Workshops with specific goals proposed and planned where necessary. Relevant fora for dissemination investigated and outreach activities planned.

Summary of the Work Plan

In addition to the ongoing maintenance and improvements by the end of year three we aim to have; the data output and reporting module fully operational, SmartDots maturity staging module fully operational and user manuals updated in line with all developments made.

Year 1	ToR a) and b) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with WGBIOP and prioritising ToRs c) and d).
Year 2	ToR a) and b) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with WGBIOP and prioritising ToRs c) and d).
Year 3	ToR a) and b) will be addressed in quarterly WebEx meetings, with the potential annual meetings intended to coincide with WGBIOP and prioritising ToRs c) and d).

Supporting information

Priority	
Resource requirements	A commitment of time from the members of the group consistent with progressing actions identified in the quarterly meetings
Participants	Chair of WGBIOP, one member from each country from the core development group (BE, DK, NO), ICES Secretariat as hosts of International SmartDots, other WGBIOP members as need be
Secretariat facilities	Community Sharepoint site, Remote meeting facilities
Financial	No financial implications
Linkages to ACOM and groups under ACOM	This is an integral component to the overall Quality Assurance framework (of Advice) that ACOM together with the Coordination group are describing
Linkages to other committees or groups	There is a very close working relationship with WGBIOP. There is a strong linkage to DIG as the main umbrella for data/software governance structures.
Linkages to other organizations	EU Commission has partially funded SmartDots and is therefore following its progress, GFCM in the Mediterranean also has interest in this system

Working group on machine learning in marine science (WGMLEARN)

2018/MA2/EOSG06 A Working group on machine learning in marine science (WGMLEARN), chaired by Ketil Malde, Norway, and Jean-Olivier Irisson, France. The group will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	22-24 May	Ostend, Belgium	Interim report by 1 July, 2019	
Year 2020	1-2 December	Online meeting	Interim report by 14 January, 2021	
Year 2021	30 August-3 September	Villefranche-sur-Mer, France	Final report by 15 October, 2021	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Review 1) new method developments in machine learning, 2) current applications of machine learning methods in marine science, and 3) their implementations and deployments in advisory and scientific processes.	Machine learning holds great potential, but it is necessary for practitioners to keep up with new developments and to gain an understanding of the opportunities and challenges with new methods.	4.1, 4.5, 3.2	1, 2, 3	On-line (live) report
b	Invite presentations (externally and internally) and review data or analysis challenges in order to discuss possible methods, approaches and technologies.	ML experts need to meet with stakeholders and data collection efforts for mutual understanding of data analysis challenges.	4.2, 4.3	1, 2, 3	On-line list of challenges
c	Communicate with DIG and the ICES Data Centre on data organization and requirements related to machine learning analysis.	For effective deployment, ML has to be integrated with data collection and data management efforts.	4.2	1, 2, 3	
d	Summarize current and future needs in marine science and identify how machine learning methods can provide solutions. Work actively to promote adoption of relevant technologies.	Future developments in the marine sciences, including project proposals, need to have an informed and up to date view of the state of the art, in order to make optimal use of the technology.	4.2, 4.3	3	

Summary of the Work Plan

Year 1	Produce the annual overview of recent developments.
Year 2	Produce the annual overview of recent developments.
Year 3	Produce the annual overview of recent developments.

Supporting information

Priority	Machine learning is a prioritized topic by DIG, and was explored in the WKMLEARN workshop in April 2018, on an initiative by ACOM. The workshop highlighted a need for a centrally organized venue to share methods and best practices between researchers, to attract outside expertise, and to support publication and dissemination of results. Long term engagement is especially needed to support deployment and integration of the new methods.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	Machine learning is a topic of considerable and broad interest, and is likely to attract participants from outside the traditional ICES organization. We expect some 30 members, similar to the attendance of the WKMLEARN workshop.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	DIG (Julie could you check does DIG sit under ACOM?, certainly they go to the SCICOM meetings), ICES Data Centre (also I think this sits under the secretariat rather than ACOM), could just be moved to the section below if we are not sure
Linkages to other committees or groups	Close working relationships with other groups that target data collection or analysis. Relevant examples are: WGFTFB (targets non-destructive fisheries sampling) WGNEPS (video surveys to monitor nephrops populations) WGFAST (analysis of acoustics data) WGBIOP and WGSMAART A planned WG for electronic monitoring of vessels
Linkages to other organizations	Machine learning is a prioritized topic by DIG, and was explored in the WKMLEARN workshop in April 2018, on an initiative by ACOM. The workshop highlighted a need for a centrally organized venue to share methods and best practices between researchers, to attract outside expertise, and to support publication and dissemination of results. Long term engagement is especially needed to support deployment and integration of the new methods.

Working Group on Technology Integration for Fishery-Dependent Data (WGTIFD)

2018/MA2/EOSG08 The **Working Group on Technology Integration for Fishery-Dependent Data (WGTIFD)**, co-chaired by Brett Alger, United States and Lisa Borges, Portugal will work on Terms of Reference (ToRs) and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	7-9 May	ICES HQ, Denmark	Interim report by 21 June to ACOM/SCICOM	Year 2019
Year 2020	6-8 October	Online meeting	Interim report by 20 November to ACOM/SCICOM	Year 2020
Year 2021	TBD	TBD, EU	Final report by Date Month to ACOM/SCICOM	Year 2021

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Inventory and review the various national fisheries dependent hardware and software applications and approaches highlighting synergies and similarities with an aim to improve cooperation and collaboration. Indicate readiness states, availability and development plan including scientific training dataset availability.	As a new WG, it is imperative to initially assess the technologies currently available and in development, the objectives of the schemes under which they are deployed in fisheries and scientific research, what data is being collected and by whom. This TOR will build upon a forthcoming paper examining REM use around the globe, to include other technologies currently deployed in fisheries	4.1, 4.5	Year 1	Draft a review paper for publication in a peer-reviewed journal.
b	Define consistent vocabulary across approaches and develop communication strategies for attracting participation in voluntary programs, and deploying and implementing electronic technologies for fisheries dependent observation.	There are a range of terms and perspectives on monitoring technologies, and a perception by some that cameras are on vessels for purely enforcement purposes. While we do not need to standardize terms, this TOR will help us better understand one another's terms, appreciate challenges for gaining participants, and collectively communicate that the primary goal of monitoring technologies is fisheries data collection.	4.1, 4.5	Ongoing	Incorporate general terms and communication strategies for writing regulations, technical documents, and various forms media. Include section in first working group report documenting use of terminology
c	Evaluate risks and benefits of technologies across different fisheries and data requirements to establish methodological acceptance for science and management.	There are many choices in designing a monitoring program, including hardware, software, data transmission, and other technical aspects. Additionally, it can be challenging to incorporate data from new sources into existing monitoring programs and stock assessments. This TOR is a handbook for those designing/redesigning their programs that illustrates	3.5, 4.4	Year 3	ICES Cooperative Research Report on best practices

		how to integrate new information of comparable accuracy/precision and quality with data collected through traditional means.			
d	Develop tools and innovative strategies for collecting, handling, processing and analysing fishery-dependent data from electronic technologies	Many technologies are being deployed alongside one another (e.g., VMS, electronic logbooks, and REM). This TOR will examine how to integrate the many data collection technologies in a single approach to ease the reporting burdens and costs of data collection, reduce duplication of effort.	4.2, 4.3	Year 3	Section of working group report providing technical guidelines on integration of fishery-dependent data from various sources in a consistent manner.
e	Report on developments in machine learning and computer vision technologies and their applications in fisheries dependent data collection and cooperate with WGMLEARN on methodological advances and communicate with WGMLEARN on the topic.	The field of computer vision and machine learning is rapidly advancing in fisheries. This TOR will be examined at each working group meeting and other opportunities of engagement to ensure our working group products reflect current applications	4.3, 4.4	Ongoing	Produce a peer-reviewed paper summarising the state of the art in year 3.
f	Organize a session at ICES ASC			Year 2	Topic session in 2020

Summary of the Work Plan

Year 1	Produce an annual overview of the working group's progress
Year 2	Produce an annual overview of the working group's progress
Year 3	Produce a final report on the working group's progress and completed TORs

Supporting information

Priority	Fisheries stakeholders and managers are looking to improve the timeliness, quality, cost effectiveness, and accessibility of fishery-dependent data by integrating innovative technology into monitoring programs. Remote electronic monitoring (REM) has clear potential to meet these challenges by incorporating cameras, gear sensors, and electronic reporting (ER) into fishing operations. We believe that ICES can provide a forum for exchanging information to share relevant technical applications and policy development to harmonize how data is collected and used for fisheries management and science.
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Resource requirements	None to ICES, nationally the programs that will provide input to this group are established, there is no need for additional resources.
Participants	Electronic monitoring is a growing topic of interest, with programs in every Region in the United States and the EU. We expect an initial working group to consist of 20-30 people, with expansion into other parts of the globe growing the group to more than 50.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	
Linkages to other committees or groups	WGMLEARN, WGCATCH, WGFAST, PGDATA WGSFD, WKSEATEC ICES Data Centre, DIG
Linkages to other organizations	

Working Group on Atlantic Larval and Egg Surveys (WGALES)

2018/2/EOSG16 The **Working Group on Atlantic Larval and Egg Surveys (WGALES)** chaired by Patrick Polte, Germany, Richard D.M. Nash, Norway (to be replaced in 2020), and Cristina Nunes*, Portugal (from 2020) will work on ToRs and generate deliverables as listed in the Table below

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019		By correspondence		
Year 2020	19–21 October 2020	Online meeting	E-evaluation	Richard D.M. Nash replaced by Cristina Nunes
Year 2021	18-20 October	Boulogne sur Mer, France	E-evaluation	
Year 2022	October	TBD	Final report by 15 December	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Review the current ichthyoplankton surveys in light of their original purposes, with respect to design, estimation methods and challenges and identify their potential for other purposes such as ecosystem surveys.	Ichthyoplankton surveys collect abundance data on early life history stages useful for estimating fish standing stock biomass (SSB) and recruitment of several fish stocks.	1.4, 2.2, 3.2	year 2, 4	
b	Survey scientist work together to evaluate and	Ichthyoplankton surveys need to keep pace with developing data needs	1.4, 3.2, 4.4	year 2, 4	

	<p>recommend methodologies and research needs for sampling, processing and data analyses for ichthyoplankton surveys, concerning the Early life history stages and the contributions from the adult components. WGALES also offers the possibility for data users to gain insights into the rationale, methodology and potential applications of fish early life stage ecology (and adult fish maturity) research.</p>	<p>and technological developments. The provision of a workshop/conference environment provides a forum for improvement, development of new ideas and innovative insights for these surveys.</p>			
c	<p>Present and report on reproductive dynamics and fish early life strategies relevant for ichthyoplankton surveys</p>	<p>Successful surveys are dependent on understanding the life-history dynamics of the target organisms and understanding how this may change with ecosystem variability and change.</p>	1.7, 2.2, 3.2	year 2, 4	
d	<p>To work together with ichthyoplankton data providers and experts to evaluate and improve surveys. This will include collaboration across members in several ICES groups including IBTSWG, WGACEGG, WGMEGS, WGSINS (WGEGGS2).</p>	<p>Specialist working groups need a forum with experts from other types of ichthyoplankton surveys and personnel working in different areas to seek guidance and advice.</p>	2.3, 3.2, 3.4	year 1, 2, 3, 4	
e	<p>Provide a standardized framework for ichthyoplankton data bases and facilitate implementation of new survey data into the ICES egg and larvae data base in collaboration with the ICES Data Center.</p>	<p>Ichthyoplankton data needs to be of high quality and centrally available for the assessment working groups and the science groups more generally to do their work and demonstrate transparent ways of working.</p>	3.2, 4.2	year 1, 2, 3, 4	Updated dataset on the ICES egg and larval database

Summary of the Work Plan

Year 1	WGALES will communicate by correspondence to act upon urgent ToR's from ichthyoplankton survey groups (ToR d)
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Year 2	WGALES will meet to address ToRs a, b, c, d, e, f
Year 3	WGALES will communicate by correspondence to act upon urgent ToR's from ichthyoplankton survey groups (ToR d)
Year 4	WGALES will meet to address ToRs a, b, c, d, f
	This Working Group meets every two years with a meeting format that covers general matters concerning ichthyoplankton surveys (ranging from new innovations in survey equipment and design through considering current ichthyoplankton surveys and their protocols) and also includes a specialised theme session or two on current and innovative relevant topics. The new topics are chosen at the end of each meeting to allow participants to work on them in the period between meetings. As such, new meeting ToRs can arise every two years to provide a focus for part of the biannual meeting.

Supporting information

Priority	The activities of WGALES are vital for the delivery of state-of-the-art ichthyoplankton surveys, ensuring high standards and incorporating new techniques and developments for the future. WGALES will lead to the cross fertilization of ideas, methodologies, developments and standardization of ichthyoplankton surveys in the ICES area. Hence providing a platform from which to improve the assessments based on the ichthyoplankton surveys.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed.
Participants	The Group will be attended by members of ICES groups, WGMEGS, WGEGBS2/WGSINS, IBTSWG, WGACEGG and guests carrying out ichthyoplankton surveys in the non-ICES areas. The Group is normally attended by some 25–30 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There are linkages with ACOM through the individual ichthyoplankton surveys groups that are associated with WGALES and their assessment groups that use plankton data.
Linkages to other committees or groups	There is a close working relationship with the all the ICES expert groups of ichthyoplankton surveys, WGMEGS, WGEGBS2/WGSINS, IBTSWG, WGACEGG and their assessment groups, WGWISE, HAWG, WGHANSA.
Linkages to other organizations	No formal linkages.