Attachment: ICES contribution to the UN GA resolution 73/124 of 11 December 2018 "Oceans and the law of the sea"

The International Council for the Exploration of the Sea (ICES) is an intergovernmental marine science organization headquartered in Copenhagen, Denmark. ICES coordinates and promotes research on oceanography, the marine environment, ecosystems, and living marine resources in the North Atlantic Ocean and adjacent sea areas.

ICES is a global scientific organization focusing inter alia on advancing the scientific understanding of marine ecosystems and their relation to human activities. Every year more than 1500 experts contribute to fulfilling the organization's mandate to give advice on human activities affecting, and affected by, marine ecosystems.

Science is the foundation on which integrated and successful environmental marine policies are built to achieve agreed objectives. ICES contributes within its remit to promote marine research, particularly in relation to living resources and marine ecosystems. ICES works at the science-policy interface, providing the best available science to sustainable management. The science is carried out in a way that is transparent, auditable, and peer-reviewed covering areas from the regional to the global level.

ICES has established formal cooperation agreements with the Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO) and the Food and Agriculture Organization of the United Nations (FAO).

As an observer to the UN General Assembly, ICES contributes and engages actively in relevant work, such as working towards the Sustainable Development Goals; contributing to the UN Decade of Ocean Science for Sustainable Development (UNESCO/IOC); the Informal Consultations of States Parties to the United Nations Fish Stocks Agreement; and the UN Open-ended Informal Consultative Process in Oceans and the Law of the Sea.

Below are examples of ICES work, within the remit of our seven science priorities. ICES work relates to the sections in the UNGA resolution on capacity building, marine environment and marine resources, including the ecosystem based approach, marine biodiversity, including Areas Beyond National Jurisdiction and EBSAs, and marine science.

Exploring Complexity; Ecosystem Science

Ecosystem overviews provide a contemporary description of status and use of ecosystems in ICES region. They identify the main environmental influences and human pressures on these ecosystems, and explain how these affect ecosystem components including marine mammals, seabirds, threatened species, and non-indigenous species. They are a valuable resource for managers, stakeholders, scientists, and others interested in Northeast Atlantic ecosystems. In 2018, an Ecosystem Overview was produced for the Baltic Sea ecoregion, adding to the six previously published overviews (Barents Sea, Bay of Biscay and the Iberian Coast, Celtic Seas, Greater North Sea, Icelandic Waters, Norwegian Sea).

Fisheries overviews describe the fishing activities and fish stock status in a given ecoregion, as well as fisheries management measures and their effects. In 2018, the Celtic Seas Fisheries Overview was published. Fisheries overviews are now available for three ICES ecoregions (Baltic Sea, North Sea, and Celtic Seas).

Our oceans are responding to a changing climate. The Working Group on Ocean Hydrography (WGOH) published the annual ICES Report on Ocean Climate, which presents measurements of water temperatures at different depths, salinity, sea level pressure, air temperature, and ice cover throughout the North Atlantic as well as identifying key trends.

Understanding and addressing climate change is a global challenge. In 2018, ICES, along with the North Pacific Marine Science Organization (PICES), Intergovernmental Oceanographic Commission of UNESCO (IOC), Food and Agriculture Organization of the United Nations (FAO), and the US National Oceanic and Atmospheric Administration (NOAA), organized the fourth International Symposium on the Climate Change Effects on the World's Oceans (ECCWO18) which took place in Washington DC, USA. Experts

from more than 50 countries shared their work on how to better understand climate impacts on ocean ecosystems and how to use this knowledge to respond. ICES Journal of Marine Science published an article comprising the drawings of artist Bas Kohler who visualized many of the presentations that took place.

Measuring Pressures; Impacts of human activities

Deep-water ecosystems are some of the most diverse but least known habitats on earth and vulnerable to anthropogenic disturbances such as bottom fishing or mineral and fossil fuel extraction. In 2018, ICES received more than 248 new records of **vulnerable marine ecosystems (VME)** indicators and VME habitat data in EU waters, which are available to support our scientific and advisory work in areas beyond national jurisdictions (ABNJ) and on biodiversity in areas beyond national jurisdiction (BBNJ). Our extensive VME database plays a central role in supporting science conducted by our expert groups and underpinning advice on interactions between bottom trawling and seabed habitats, conservation measures and biodiversity in exclusive economic zones (EEZ) and ABNJ.

ICES provided advice to the EU on areas where VMEs are likely to occur and to be impacted by bottom fisheries in the deeper waters of the Northeast Atlantic. This advice also described the "footprint" of bottom fishing activity in Northeast Atlantic EU waters between 2009–2011 at different depths (200–400 metres, 400–800 metres, and 800 metres or more) and showed where the footprint overlapped with VME locations.

ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV) and the Working Group on Introductions and Transfers of Marine Organisms (WGITMO) developed **the first ICES Viewpoint**, which concerns the control and management of ships' biofouling to minimize the transfer of invasive aquatic species. Viewpoints are unsolicited advice that allow expert groups to draw attention to the implications of new knowledge for society and the management of marine activities. They highlight our capacity to provide impartial evidence-based analyses of emerging topics related to the state and sustainable use of the seas and oceans and draw on the diverse expertise of the large community of scientists participating in ICES work.

In 2018, a data call was issued for **data on bycatches** of marine mammals, birds, elasmobranchs and other protected species along with data on fishing effort. These new data holdings were used to assess fisheries' impacts on small cetaceans and other marine animals: The bycatch risk to harbour porpoises and common dolphins in the southern part of the Celtic Seas and to common dolphins in the Bay of Biscay may exceed internationally adopted thresholds of acceptability.

Monitoring the Sea; Observation and Exploration

A number of expert groups are involved in the coordination of surveys each year: **International Bottom Trawl Survey Working Group** (IBTSWG), Baltic International Fish Survey Working Group (WGBIFS), Working Group on Beam Trawl Surveys (WGBEAM), Working Group of International Pelagic Surveys (WGIPS), Working Group on Acoustic and Egg Surveys for Sardine and Anchovy in ICES areas 7, 8, and 9 (WGACEGG), Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS), Working Group on Surveys on Ichthyoplankton in the North Sea and adjacent Seas (WGSINS), Working Group on Atlantic Fish Larvae and Eggs Surveys (WGALES), and Working Group on Nephrops Surveys (WGNEPS). ICES coordinated surveys used an estimated 2000 ship days in 2018.

Underwater television (UWTV) surveys have played a significant role in gathering data for use in the stock assessments of the expanding Nephrops (Norway lobster) fishery.

ICES Cooperative Research Report No. 340 written by members of the Working Group on Nephrops Surveys (WGNEPS) describes the use of UWTV surveys in the assessment and provision of management advice for Nephrops stocks.

Cooperative Research Report, No. 343 on **"Fifty years of marine tag recoveries from Atlantic salmon"** presented data on salmon movements as determined by tagging. Salmon were tagged in home waters and subsequently recaptured in the oceanic salmon fisheries around Faroes, Greenland, and the Norwegian Sea. The datasets described in the report are together referred to as the North Atlantic Salmon Tag Recov-

ery database (NASTR). Tagging data provide crucial insights into salmon movements and mortality as scientists seek to improve understanding of wild Atlantic salmon distribution and migration at sea, and the underlying causes of mortality. These insights are particularly important given the reduction in salmon abundance over the last two decades.

Advancing our Approaches; Emerging Techniques and Technologies

Machine learning has many potential applications in the marine sciences, which are heavily reliant on processing of voluminous data. It can identify patterns and relationships in these data that may not be apparent when applying conventional methods. Machine-learning applications for electronic monitoring of fishery-dependent data are of increasing interest to management bodies in North America and Europe. In April, a workshop explored how machine learning could benefit ICES science and advice and led to the creation of a new group, the **Working Group on Machine Learning in Marine Science (WGMLEARN)** to share methods and best practices between researchers.

Image recognition is one application of machine learning. 2018 saw the launch of **SmartDots, an otolith reading software** developed by the Flanders Research Institute for Agriculture, Fisheries And Food (ILVO), Belgium and the Danish National Institute for Aquatic Resources (DTU Aqua) with ICES collaboration. The development of SmartDots within ICES is guided by the Working Group on SmartDots Governance (WGSMART). SmartDots keeps bias in age data to a minimum and identifies errors resulting from incorrect ageing practices. The tool will enable huge improvements in the overall quality assurance procedures that are required when providing biological data and has potential for further development in both otolith related and a wider range of biological studies.

Effective data governance is necessary to ensure data are findable, accessible, interoperable, and reusable - the so-called FAIR principle. Requirements for effective governance span the entire process from the collection and processing of data, through to its use in assessment and analysis, to the eventual output of data or data products that underpin a scientific finding or advice. **The Transparent Assessment Framework (TAF)**, launched in December at GFCM Fish Forum in Rome, is a system that will better structure the entire ICES stock assessment procedure by having all assessment data, methods, and results available online. It is an important step towards more effective data governance. TAF enables anyone to easily find, reference, and download information from any stage of the assessment process after the advice for a particular stock has been released.

Better integration and visualization of data is essential to improve accessibility and comprehension for scientists, administrators, and the public. In 2018 we hosted the first ICES hackathon, which stimulated new ideas and thinking in these areas where teams competed to present existing ICES data more effectively.

Securing Sustainability; Seafood Production

In 2018, ICES advice on fishing opportunities covered 224 stocks: 12 stocks in Iceland and East Greenland, 8 stocks in the Barents Sea, 3 stocks in the Faroe Plateau, 56 stocks in the Celtic Sea and West of Scotland, 33 as well as 9 reopened stocks in the North Sea, Eastern Channel, Skagerrak, and Kattegat, 29 stocks in the Bay of Biscay and Atlantic Iberian Waters, 11 stocks in Baltic Sea, and 21 widely distributed and migratory stocks. This represents 7.7 million tonnes or approximately 90% of the catch in the Northeast Atlantic and Baltic Sea. The complexity of the advice on fishing opportunities is increasing as a result of the adoption of stock specific management strategies.

ICES provides annual advice to the North East Atlantic Fisheries Commission (NEAFC) on fish stocks in the Northeast Atlantic based on analyses by the Working Group on the Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP) and other working groups. With the uptake of "data limited" methods which provide fisheries advice for stocks with reduced available data, the number of stocks has increased to 35–50 stocks a year.

The diversity of advice requests increases every year, requiring a wider range of expertise and cooperation: currently spanning marine ecology, valuation, gear technology, spatial mapping, and stakeholder facilitation.

With the rapid growth of aquaculture, ICES is committed to providing the science and advice that is needed to inform understanding of its potential and impacts and to support emerging needs in member countries and beyond. In 2018, the number of **aquaculture expert groups** in ICES increased to seven and now includes groups on the carrying capacity of aquaculture, scenario planning, and open ocean aquaculture.

Providing Better Options; Conservation and Management Science

A range of physical pressures disturb seabed habitats. ICES workshop on scoping benthic pressure layers (WKBEDPRES1) identified the main physical pressures on the seabed in European waters and derived methods for describing the aggregate impact of these pressures. For the four EU regions examined: fishing caused the most extensive physical abrasion, aggregate extraction and dredging were also of relevance but much less extensive. This work will continue in 2019, and will underpin advice on sea floor integrity for the Marine Strategy Framework Directive.

ICES maintains a **database of Vulnerable Marine Ecosystem (VME)** indicators and habitats (covering deep water areas inside and outside national jurisdiction) which currently holds more than 40 000 records spanning more than 60 years. The database, based primarily on the work of the ICES/ NAFO Working Group on Deepwater Ecology (WGDEC), supports annual advice to NEAFC for the protection of biodiversity in the Northeast Atlantic on seabed ecosystems, such as cold-water coral reefs and coldwater seeps that require protection from fishing activities. Currently, there are 13 closures to mobile bottom fishing in areas beyond national jurisdiction (ABNJ) in the Northeast Atlantic that are supported by this advice.

Conceptual differences between the International Union for Conservation of Nature (IUCN) assessments and those of scientific bodies supporting fisheries management organisations, led the EU to ask ICES to compare the differing assessment methods and if IUCN methods could benefit fisheries management challenges. ICES advised that the two approaches were designed for different purposes: IUCNs approach assesses the risk or threat of a group of organisms going extinct, while ICES advice on fisheries management assesses the status of a stock relative to its productivity and its capability to produce maximum sustainable yield (MSY). Incorporating IUCN assessments offers few operational benefits into fisheries management as they do not assess the exploitation level relative to precautionary and MSY reference points.

In a workshop to develop the basis of biodiversity advice to the European Commission, ICES considered the performance of a hierarchy of status assessment methods for birds, mammals, turtles, fish and cephalopods in the Marine Strategy Framework Directive. The work highlighted advantages and risks associated with integrating decisions about biodiversity status through a hierarchy.

Benefitting from the Sea; Sea and Society

The adoption of the 1982 Law of the Sea Convention by the United Nations (UN) stands as a defining moment in the extension of international law to our shared seas and oceans. ICES has formal cooperation agreements with two UN organizations - the Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO) and the Food and Agriculture Organization of the United Nations (FAO). In 2018, the Sixth (Legal) Committee of the UN General Assembly granted ICES observer status and we will now contribute further to the UNs work on achieving the Sustainable Development Goals (SDGs).

We will also share our experience in providing scientific evidence for areas beyond national jurisdiction during the Inter-Governmental Conference on a new legal instrument for biodiversity beyond national jurisdiction.

In October, an ICES/UNECE (UN Economic Commission for Europe) workshop on management tools and standards in support of Sustainable Development Goal 14 “Life below water” looked at assessing and managing the risks of achieving SDG 14 targets and how these targets map to the Marine Strategy Framework Directive descriptors.

LME:LEARN, a project of the UN Development Programme aims to improve global ecosystem-based governance of Large Marine Ecosystems and their coasts by generating knowledge, building capacity, harness-

ing public and private partners and supporting south-to-south and north-to-south learning. ICES is leading the LME: LEARN Ocean Governance Working Group, and organizes training courses for LME practitioners and managers. In 2018, the Working Group developed a Governance Toolkit, which provides descriptions, illustrative examples, tools and other helpful links for analysing and strengthening LME governance frameworks. In partnership with NOAA, targeted training courses were developed using the Governance Toolkit as course material.

The Strategic Initiative on the Human Dimension (SIHD) has been developing strategies to support the integration of social and economic science into ICES and facilitated the creation of two new expert groups. The Working Group on SOCIAL Indicators (WGSOCIAL) works to improve the integration of social sciences in our ecosystem overviews and integrated ecosystem assessments (IEAs) through the development of culturally relevant social indicators. The Working Group on Economics (WGECON) was established to address the need to better incorporate fisheries economics into ICES science and advice and will connect with related international organizations, reporting on the trade-off analysis of fishing impacts and ecosystem services, and measuring the economic value of fishing.