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Thu. Nov 12, 2026 4:00 PM - 5:30 PM JST | Thu. Nov 12, 2026 7:00 AM - 8:30 AM UTC | Room D (Icho) (3F)

Oral D3 OSID & IESS

Chair: Bruno Buongiorno Nardelli, Akira Nagano

4:00 PM - 4:15 PM JST | 7:00 AM - 7:15 AM UTC

[OECfne_2-01] Digital Twin applications for dynamic assessments of marine biodiversity in European coastal waters

*Matthias Obst[1] (1. Department of Marine Sciences, University of Gothenburg (Sweden))

4:15 PM - 4:30 PM JST | 7:15 AM - 7:30 AM UTC

[OECfne_2-02] Collection and Use of Fishing Vessel Data: Practical Use Cases in Japan

*Takuto Hazama (1. FURUNO ELECTRIC CO., LTD. (Japan))

4:30 PM - 4:45 PM JST | 7:30 AM - 7:45 AM UTC

[OECfne_2-03] Building Ireland’s Digital Twin of the Ocean: From Trusted Marine Data to Operational Decision Support

*Gerald Lyons[1] (1. Marine Institute (Ireland))

4:45 PM - 5:00 PM JST | 7:45 AM - 8:00 AM UTC

[OECfne_2-04] A Seagrass EOV and –Enabled Coastal Biodiversity Digital Twin

*Takehisa Yamakita[1] (1. JAMSTEC/APMBON (Japan))

5:00 PM - 5:15 PM JST | 8:00 AM - 8:15 AM UTC

[OECfne_2-05] African Ocean Biodiversity Atlas: Advancing Digital Twins of the Ocean Through AI-Enabled Biodiversity Intelligence and Community Knowledge

*Peter Teye Busumprah[1] (1. Ocean Rock Base and Africa Ocean Alliance (Ghana))

5:15 PM - 5:30 PM JST | 8:15 AM - 8:30 AM UTC

[OECfne_2-06] Conceptual Design of a Digital Twin-Based Integrated Framework for Subsea Infrastructure Management

*Sujin Son[1] (1. Sundosoft Co., Ltd. (Korea))

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[OECfne_2-01] Digital Twin applications for dynamic assessments of marine biodiversity in European coastal waters

*Matthias Obst[1] (1. Department of Marine Sciences, University of Gothenburg (Sweden))

Biological monitoring needs to improve radically to serve our understanding of marine ecosystems and biodiversity under long-term global change and multiple stressors. Over the last decade, high-throughput monitoring technologies including genomics, hydroacoustics, telemetry, and computer vision have gained a lot of traction among marine scientists, but the quickly mounting volumes of data typically prevent scientists from obtaining deeper insights into ecosystem function and change. The European Digital Twin Ocean programme addresses this challenge and develops a digital environment that brings together data and analytical services supporting effective monitoring, restoration, and management of marine ecosystems by 2030. In 2023, the DTO-BioFlow project was initiated to support the integration of biodiversity in the European Digital Twin Ocean. Based on the ongoing work in this project, this talk will introduce some important concepts for marine biodiversity and present demonstrator use cases developed for marine ecological research. Examples feature ecological power tools and predictive applications available as open-source services through the European Digital Twin Ocean platform EDITO. The services are currently used in management of marine protected areas, offshore wind test sites, aquacultures, and for predicting marine invasive species. We will present results of scientific studies using these DTO services, explain how this approach is new, and how it can support ecosystem management as well as nature positive development. We will also highlight the advantages of using the DTO and EuroHPC infrastructures for such computationally complex and demanding tasks.

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[OECfne_2-02] Collection and Use of Fishing Vessel Data: Practical Use Cases in Japan

*Takuto Hazama (1. FURUNO ELECTRIC CO., LTD. (Japan))

In Japan and many other countries, the fisheries industry is placing greater importance on improving daily work through data use. This need is increasing because the industry faces issues such as changes in fishing grounds, labor shortages, and the need for better resource management. FURUNO is promoting the use of fishing vessel data to support sustainable fisheries, the growth of the fisheries industry, and the efficient use of fishery resources.
The aim of this presentation is to show how fishing vessel data can be collected and used in practical fisheries. It introduces “Ryoshi Diary,” a system that supports the process from data collection to the use of analysis results. The word “Ryoshi” means “fisher” in Japanese. The data include vessel position, time, fishing operation records, and data from marine electronic devices. The system collects data from devices on fishing vessels, stores the data in cloud services, and presents the results through web services. This allows users to check past results and compare fishing activities over time.
This presentation also describes two use cases in Japan. The first is a local project in which data from many fishing vessels were collected and used as regional fishing vessel data. Collecting data from many vessels over a short period made it possible to cover a wide range of fishing grounds. This result suggests that regional fishing vessel data may help users understand long-term trends in fishing grounds. The second is a single-vessel project using one bottom trawler, in which one fisher collected and analyzed fishing ground data for three years. In this use case, the data made it possible to study changes in catch composition and consider possible reasons for these changes. These use cases suggest that continuous collection and use of fishing vessel data can turn daily fishing activities into useful knowledge for sustainable fisheries.

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[OECfne_2-03] Building Ireland’s Digital Twin of the Ocean: From Trusted Marine Data to Operational Decision Support

*Gerald Lyons[1] (1. Marine Institute (Ireland))

Ireland is advancing a Digital Twin of the Ocean (DTO) to support sustainable ocean management, marine spatial planning and climate resilience. Building on decades of marine observations, data stewardship and national monitoring programmes, the Marine Institute (MI) is developing an operational and interoperable DTO ecosystem that connects trusted observations, models, data services, analytics and decision-support tools. Rather than a single visualisation platform, Ireland's approach focuses on creating reusable digital capabilities that enable data, models and users to interact across multiple marine management applications.

The MI manages marine data through trusted pipelines, standardised metadata, and open publication services backed by internationally recognised quality and governance frameworks, including IODE accreditation and CoreTrustSeal certification. Adopting a cloud-first approach the MI is modernising spatial infrastructure, marine portals and digital services while enabling integration with emerging European data spaces and advanced analytics environments. These foundations support capabilities including real-time data integration, scenario modelling, immersive 3D visualisation, and AI-driven analysis.

As Ireland's National Oceanographic Data Centre and an active contributor to European marine data initiatives, the MI provides trusted and reusable data supporting applications across government, research, industry and society. These foundations are reinforced by a strong organisational data culture where stewardship, quality, interoperability and reuse are shared responsibilities.

Practical applications are already emerging through the recently launched cloud-native Marine Atlas, Ireland's maritime spatial planning initiatives, sea sensitivity assessments and marine policy development, demonstrating how trusted data and predictive capabilities can be translated into actionable decision support.

The presentation demonstrates how trusted marine data infrastructure, supported by strong organisational governance and data culture, can evolve into operational Digital Twin capabilities. Ireland's experience provides transferable lessons for the international DITTO community on the technical, organisational and governance foundations required to move from authoritative marine data services to interoperable, user-driven Digital Twins of the Ocean.

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[OECfne_2-04] A Seagrass EOV and –Enabled Coastal Biodiversity Digital Twin

*Takehisa Yamakita[1] (1. JAMSTEC/APMBON (Japan))

Under GOOS/MBON, “Seagrass cover and composition” has recently been finalized as a BioEco Essential Ocean Variable (EOV), with percentage cover, species composition, and areal extent defined as core subvariables. In Japan, long-term monitoring is conducted across six regions under the Monitoring Sites 1000 program; however, its spatial coverage remains insufficient. Satellite remote sensing can help address this gap by enabling broad-scale mapping of ecosystem extent. Nevertheless, detecting and interpreting rapid, localized changes—such as the regional loss of seagrass meadows within a single year reported by Yamakita et al. (2016)—still require in situ verification.

We propose a high-throughput DT-BIO FLOW that integrates satellite and aerial imagery, field-based vegetation and community surveys, eDNA, fixed cameras, and citizen-science observations, including BIOME. Beyond mapping ecosystem extent, frameworks such as TNFD require assessments of ecosystem condition, species extinction risk, population dynamics, and ecosystem function. Meeting these requirements calls for high-resolution predictions of habitat suitability and responses to climate change and alternative nature futures. Because condition-, function-, and species-level assessments are often constrained by the availability of in situ observations, we emphasize the importance of distributed observation networks involving fishers, coastal managers, and citizen scientists, supported by robust quality-assurance procedures and tangible benefits for participants.

Data will be harmonized into Darwin Core–compliant Event, Occurrence, and Extended Measurement or Fact (EMoF) tables and published through OBIS to support standardization, quality control, provenance tracking, and reuse. We identify key infrastructure challenges, including the integration of heterogeneous data streams, iterative model updating, and uncertainty assessment. We also examine progress and challenges associated with Japan’s pioneering blue-carbon credit schemes, including JBlueCredit®, and ocean-health index that capture co-benefits—such as biodiversity, fisheries, and water purification—beyond carbon sequestration alone. Finally, we discuss the framework’s potential to support evaluation of marine protected areas, Nature Positive outcomes at OECM sites, TNFD-related reporting, and adaptive fisheries and coastal management, while identifying bottlenecks to operational implementation.

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[OECfne_2-05] African Ocean Biodiversity Atlas: Advancing Digital Twins of the Ocean Through AI-Enabled Biodiversity Intelligence and Community Knowledge

*Peter Teye Busumprah[1] (1. Ocean Rock Base and Africa Ocean Alliance (Ghana))

Digital Twins of the Ocean (DTOs) are transforming ocean science by integrating diverse datasets into dynamic digital environments that support ecosystem monitoring, forecasting, and evidence-based decision-making. However, significant data gaps and fragmented biodiversity information continue to limit the representation of African marine and coastal ecosystems within emerging global digital ocean infrastructures. Addressing these gaps requires interoperable platforms that integrate ecological observations, environmental data, and local knowledge into accessible digital systems.

The African Ocean Biodiversity Atlas (AOBA) is an AI-enabled geospatial platform designed to strengthen biodiversity intelligence for Africa's marine and coastal ecosystems while contributing to the development of Digital Twins of the Ocean. The platform integrates marine biodiversity records, habitat information, Earth observation data, oceanographic variables and community-generated observations within an interoperable framework aligned with international ocean data standards. Artificial intelligence and machine learning are applied to automate species distribution modelling, biodiversity hotspot mapping, habitat classification, ecological change detection, and environmental risk assessment.

A distinguishing feature of AOBA is the integration of Indigenous and local ecological knowledge alongside scientific observations, creating a more comprehensive digital representation of marine ecosystems. The platform supports community-led marine conservation, locally managed marine protected areas, ecosystem restoration, sustainable fisheries management, marine spatial planning, and biodiversity policy development by providing stakeholders with real-time, decision-ready information.

The African Ocean Biodiversity Atlas (AOBA) is a UN Ocean Decade endorsed project dedicated to integrating biodiversity data, advanced analytics, and community knowledge. It exemplifies how regional digital infrastructures can enhance the biodiversity component of Digital Twins of the Ocean. This initiative aims to foster more inclusive, interoperable, and scalable digital ocean ecosystems, thereby improving environmental monitoring, supporting climate resilience, and enabling informed decision-making for sustainable ocean governance across Africa.

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[OECfne_2-06] Conceptual Design of a Digital Twin-Based Integrated Framework for Subsea Infrastructure Management

*Sujin Son[1] (1. Sundosoft Co., Ltd. (Korea))

With the expansion of offshore wind farms and subsea power and communication networks, various types of subsea infrastructure - including submarine cables, pipelines, and artificial reefs - are continuously increasing in Korean waters. However, information on these assets, such as location, burial depth, permitting, and maintenance records, is managed separately by different organizations, limiting efficient management and spatial decision-making. As marine biodiversity conservation becomes a significant issue in the installation and management of such structures amid the climate and biodiversity crises, the demand for systematic marine spatial planning (MSP) is expected to grow. This study defines subsea infrastructure as interoperable digital objects and designs a digital twin-based integrated framework linked with MSP.

The framework standardizes core data elements for submarine cables, pipelines, artificial reefs, and subsea structures, and represents each asset as an interoperable operational digital object by integrating location and facility attributes, permitting, inspection, maintenance, and risk information, together with heterogeneous geospatial data such as electronic navigational chart-based bathymetry, seabed topography, field survey data, and public water occupancy permits. The digital twin environment provides 3D visualization, spatial analysis, and site suitability assessment to support integrated management and spatial decision-making.

In particular, overlay analysis with key MSP layers - marine use zones, protected species habitats, marine protected areas, and regulatory zones for safety and defense - enables pre-installation review of spatial conflicts and risks, while supporting integrated management of existing facilities' conditions and maintenance histories. The framework thus consolidates distributed information into standardized digital objects, functioning as a decision-support system across the full lifecycle of planning, installation, operation, and maintenance.

In the second year, a pilot dataset will be developed for a demonstration area, integrating real-time monitoring, marine environmental observations, and field survey data to realize an operational ocean digital twin, ultimately supporting national subsea infrastructure management and marine spatial policy.

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