Toste Tanhua and Anya Waite

Co-Chairs, Global Ocean Observing System (GOOS) Steering Committee

Dear Toste and Anya,

The IMDOS Coordination Office and Interim Steering Committee requests the GOOS Steering Committee to consider the attached application for the Integrated Marine Debris Observing System (IMDOS) to be officially affiliated as a GOOS Project.

Following the recommendations from the 7th Session of the GOOS Steering Committee and in line with the GOOS 2030 Strategy, GOOS Biogeochemistry Panel has been working since 2019 with many international actors towards establishing global coordination of sustained observations of marine plastics debris, supporting a very ambitious community vision for an Integrated Marine Debris Observing System (IMDOS; Maximenko et al., 2019). Today IMDOS continues to be developed as a joint initiative of the GOOS, the Group on Earth Observations (GEO) Blue Planet, and the United Nations Environment Programme (UNEP) Global Partnership On Plastic Pollution and Marine Litter (GPML); and in collaboration with the Scientific Committee on Oceanic Research (SCOR) Working Group #153, GESAMP Working Group #40, the International Ocean Colour Coordinating Group Task Force on Remote Sensing of Marine Litter and Debris, and the Ministry of Environment Japan (MOEJ), among others. IMDOS has also already benefited from extended consultations with GOOS Panels of Experts, GOOS OCG, and several of the GRAs.

IMDOS aims to provide guidance and coordination for a global sustained observing system to strengthen the scientific knowledge on marine debris/litter pollution. Designed as a collective impact organization, it will serve as backbone support for many international and national organizations and initiatives that: (i) share a vision for coordinated marine debris observations to address the complex issue of marine pollution, (ii) collect data and report results consistently, (ii) contribute with differentiated yet mutually reinforcing activities, (iv) engage in consistent and open communication, and (v) have a backbone coordinating structure.

Monitoring global marine plastic litter and understanding its transport are the key pillars for supporting the establishment of realistic plastic debris reduction targets (e.g. UN SDGs and UNEA5-2 Resolution 14) and developing policies to reach them. By being integrated into the GOOS structures, IMDOS would utilize and expand the capacity of GOOS to collect accurate, harmonized and up-to-date information on marine debris and plastic pollution. The development of the new Marine Plastics Debris EOV provides global requirements for in situ and remote sensing observations according to user needs.

We are confident that through regular and close interaction with many relevant structures of GOOS and guided by the GOOS Steering Committee, IMDOS will be strongly equipped to realize its mission, and that of GOOS as well. We look forward to IMDOS being officially recognized as a new component to the Global Ocean Observing System over the next decade.

Sincerely,

Artur Palacz - GOOS Biogeochemistry Panel Project Office & interim IMDOS Project Office

Audrey Hasson, Mine Tekman - GEO Blue Planet EU Office & interim IMDOS Project Office

On behalf of the IMDOS Interim Steering Committee

IMDOS Request for Affiliation as a GOOS Project

Below we outline the rationale for presenting IMDOS as a GOOS Project, following the criteria provided by the "GOOS Projects: principles for affiliation, Document version 4 (25 May 2015)."

Advantages of affiliation as a GOOS Project

IMDOS will benefit from the recognition as a GOOS Development Project in principle by:

- regularly and directly interfacing with all relevant GOOS structures which have the potential to help IMDOS establish a globally coordinated, sustained and integrated observing system which delivers high quality data on marine debris to meet the science and policy requirements expressed by SDG 14.1.1b global indicators, and others recommended for global scale monitoring (GESAMP, 2019) and specified under the new Marine Plastics Debris Essential Ocean Variable;
- liaising with GOOS partners responsible for international marine data management to address the additional challenges in extracting quality information from existing data, lack of interoperability of data streams, and limited integration of existing data sources;
- receiving guidance and support in the implementation of IMDOS as a truly integrated observing system which reconciles the scientific and environmental monitoring and adopts internationally agreed harmonized and standardized monitoring protocols for free, open and FAIR data;
- promoting IMDOS mission and enhancing IMDOS visibility through the communication channels of GOOS, its structures and associated UN Decade Programme activities, to support IMDOS in identifying and attracting new stakeholders and funders.

Principles for association as a GOOS Project

A global coordination for IMDOS is being established in partnership with leading international organizations, institutions, expert working groups, and other stakeholder groups, in response to a clearly stated need articulated in the OceanObs'19 Community White Paper by Maximenko et al. (2019). IMDOS fits to the scheme of a GOOS development project with a broad scope covering requirements, observations, and data systems relevant to GOOS. IMDOS targets to establish a global coordination body by forming task teams/working groups to address basic challenges in monitoring and associated activities at the observation-modelling and data collection-synthesis interfaces. In parallel, planned development of regional hubs, potentially also benefiting from GRA coordination of activities and infrastructures, would ensure global sampling coverage and coordination.

[Basic GOOS principles]

1. *Supports GOOS Principles, in particular related to:*

   a. *being designed to meet defined objectives on the basis of user needs*

      IMDOS will coordinate activities to gradually increase the readiness level of the observing system and data management, aiming for operational capacity by 2030. To achieve this aim, the following objectives have been set up accepted as initial Terms of Reference of IMDOS:

      Review and guidance

      - Define a strategy and priorities for coordinated and harmonized marine debris observations based on most relevant monitoring methods to fulfil scientific and societal requirements according to the Regional Seas Programme Action Plans.
      - Develop and maintain an implementation plan with a set of specifications and status reporting capacity for measurements included under the Marine Plastics Debris Essential Ocean Variable and as needed to inform or develop new global indicators (e.g., SDG 14.1.1.b).
      - Define a strategy to develop future global new indicators (e.g., harm) to better address the various components of the plastic cycle at sea.

Technical development

- Interface between in-situ and remote sensing observing components according to Marine Plastics EOV and indicator requirements.
- Interface between the observing and modelling community to enable the development of a Digital Twin of the Ocean for Marine Debris Pollution.
- Integrate marine debris observations into existing ocean observing networks and communities of practices coordinated by GOOS Observations Coordination Group (OCG) or GOOS Biology & Ecosystems Panel, and if needed establish new networks guided by the OCG network standards.
- Promote the use of international agreements on measurement methodologies and best practices, data quality control and quality assurance procedures building upon GESAMP Working Group 40 guidelines and other standardization efforts developed by expert groups; and where relevant augment existing Standard Operating Procedures (SOP) for these networks.
- Promote and evaluate technological advancements with the potential to increase the readiness level of global observing approaches.

Network, promotion, capacity development

- Develop and support training activities for enhanced use of standard sampling protocols and best practices in marine debris data collection.
- Promote and develop interoperable data management activities to ensure open and fair access to, and preservation of, fully documented marine debris data feeding into GPML Digital Platform. Train IMDOS users to promote its products and applications and to maximize benefits to the community.
- Work with stakeholders to raise funds to implement and sustaining the structure of IMDOS.
- Seek support for data harmonization and synthesis efforts as required by scientific and policy stakeholders.
- Establish collaboration and continuous communication with relevant organizations and programs along the value chain of marine debris observing, including innovative methods, advanced coordination of operations to provide guidance and an interface with data management systems

b. intent to sustain observations over the long term,

IMDOS intends to provide coordination of long-term observations in support of existing and future global assessments and decision-making. A long-term strategy to combat such a persistent and complex pollutant as plastic requires first identifying the extent of the problem through monitoring initiatives, and secondly, to assess the effectiveness of mitigation measures on the health of the oceans. These targets can only be achieved by coordinating long-term sustained observations to provide integrated and harmonized information on marine debris pollution.

c. addressing the range from data capture to end products and services.

IMDOS considers the whole observing value chain as described by the Framework for Ocean Observing, starting from data collection to analyses and data synthesis product development. Harmonization and standardization of data collection and processing methods is a critical task for IMDOS, along with facilitation of activities and technical workshops aimed at harmonization of existing datasets towards global products (e.g. Isobe et al., 2021). In parallel, IMDOS will address aggregated data product needs for validation of numerical ocean and remote sensing model calibration and validation. Collected data will be integrated and synthesized into indicators and decision-support tools through relevant data centers and knowledge platforms, in accordance with the UNEP GPML Digital Platform requirements and those of UN Regional Seas Programme Action Plans, Digital Twin of the Ocean.

d. commitment to timely, free, and unrestricted access to data and associated metadata,

IMDOS will promote the collection and delivery of free, open and FAIR data through a global, federated data system in line with the data strategies of GOOS, and where possible, building on existing data infrastructures already participating in the federated data management structure of GOOS.

e. *commitment to adhering to internationally-recognized standards and best practices for observations and data management;*

Data collection as well as standardization and harmonization will not only focus on establishing requirements, but also will ensure that the guidelines will comply with hitherto developed standards by the European Commission Joint Research Center, MSFD Technical Group on Marine Litter in Europe, GESAMP Working Group #40, and other IOC and UNEP Communities of Practice or Expert Working Groups. Close interaction with IOC/GOOS WG on Ocean Best Practices has already been established and would further be strengthened through recognition of IMDOS as a GOOS Project.

2. *Uses the Framework for Ocean Observing and associated tools such as the Strategic Mapping and EOV / observing network specification sheets;*

As part of the EU H2020 EuroSea project, Marine Plastics Debris has been developed as a new type of Human Pressure EOV. The current initial version of the Marine Plastics Debris EOV Specification Sheet (Palacz et al., 2022) is in the process of undergoing final expert and broad community review and upon its completion, will be presented for formal recognition to GOOS SC. The proposed EOV sub-variables complement and expand the current set of level 1 (global) SDG 14.1.1b indicators, in line with state-of-the-art guidelines for global monitoring of marine debris published by GESAMP WG40. Moreover, IMDOS sets out to recommend augmenting or refining existing sampling protocols used by relevant coordinated networks or GOOS communities of practice, with contributions to refining observing network specification sheets where needed.

[goals]

3. *Is aimed at increasing the readiness of requirements, observing networks, data systems, and/or information-generation activities;*

IMDOS targets dynamic integration of shoreline and at-sea in situ observations, remote-sensing, and numerical modelling by supporting gradual increase of readiness levels in Marine Plastics Debris EOV requirement setting, observing capacity and data management. Each element of the Framework for Ocean Observing will be addressed by individual Task Teams or Working Groups established within IMDOS. Details of this modus operandi will be explained in the currently drafted IMDOS Strategy and Implementation Plan.

[context]

4. *Identifies and manages interfaces with existing GOOS structures and projects, as well as other existing national and international networks, systems and organizations where appropriate*

Through GOOS Biogeochemistry Panel, which provides interim coordination support for IMDOS, interfaces with all relevant GOOS structures have been managed since the onset of IMDOS. These interfaces include frequent strategic and technical discussions with: GOOS Biogeochemistry and BioEco Panels of Experts, Ocean Best Practices WG, GOOS OCG and OceanOPS, and selected GRAs.

IMDOS benefits from a three-way partnership between GOOS, GEO Blue Planet and UNEP GPML to establish effective and long-term coordination of global marine debris monitoring, according to the needs of science and policy users. It builds on initiatives and activities by several international expert working groups of SCOR, IOC and other, and has established close collaborations with the International Ocean Colour Coordination Group to strengthen the interface between in situ and remote sensing observing communities, and with other organizations dealing with data

harmonization and management (e.g. Ministry of Environment Japan, EMODnet Chemistry, NOAA NCEI).

5. *maintains communication and develops a strategy to leave a legacy with a GOOS-related structure; and*

   It is envisioned that a member of GOOS will be permanently included as ex officio member of IMDOS SC. It is expected that in the long-term (10-15 years), a number of IMDOS elements would be directly represented on GOOS OCG in form of new dedicated observing networks, or as elements of already existing observing networks. In parallel, representation of IMDOS should be ensured in one of the GOOS Panels of Experts nominated to be the official curator of the Marine Plastics Debris EOV. Currently, IMDOS is recognized as one of the activities of GOOS Biogeochemistry Panel and the future potential presence of IMDOS on GOOS OCG has also already been discussed during several OCG meetings.

6. *Is independently managed.*

   Short-term, part-time coordination support for IMDOS, guided by an international Interim Scientific Committee, has been provided since 2021 by GOOS and GEO Blue Planet with funding from the European Union projects: H2020 EuroSea and EU4OceanObs. Current level of coordination and communication support is ensured until October 2023, with ongoing fundraising to extend and expand the available resources.

   The successful long-term implementation of the IMDOS vision will need to be realized with a dedicated global coordination office with geographically distributed staff members of 3-5 employees.

Ideal characteristics of Projects

- *Focus on developing long-term sustained infrastructure (new or redeveloped) they leave behind to GOOS*
- *Clear objectives and expected results within a sufficient, but limited period of time. (GOOS Projects are not a substitute for routine ongoing GOOS elements/activities)*
- *Milestones, dates, costing (realizable within a specified period)*

  The IMDOS Strategy and Implementation Plan until 2030 are two documents currently being drafted, and they will provide a realistic timeline for moving IMDOS up the readiness level scale towards mature. The IP will include major milestones and an estimate of cost required to achieve them. The initial phase of IMDOS implementation targets the coordination of existing monitoring schemes of seafloor debris, sea surface microplastic, beach/coastline debris and interactions with biota, specifically with sea turtles as a case study including citizen science and ships of opportunity activities. These campaigns are currently being held by several national and international parties. Global harmonization of data and development of sampling protocols constitute the other two key types of activities pursued by IMDOS in the initial stages of operation. Once the initial stages of development of the observing capacity and data management are completed, IMDOS is expected to be properly integrated into the fixed components of GOOS.

- *Fundable:*

  The way forward for addressing marine litter pollution has recently been paved by the historic resolution (Resolution 14 of UNEA-5.2) to end plastic pollution and forge an international legally binding agreement by 2024, henceforth referred to as “Plastic Treaty”, endorsed by representatives from 175 nations at the 5th session of the United Nations Environment Assembly (UNEA-5) in March 2022. With UNEP GPML, one of the three proposed parent programs for IMDOS, having the UN mandate to establish global coordination of marine plastic pollution monitoring, there is tremendous capacity for IMDOS to play a fundamental role in providing technical support for the implementation of the Plastic Treaty. UNEP GPML’s newly launched Digital Platform aims to offer a single point of access for current, accurate data and information to support stakeholders’

needs, ranging from scientific research to technological innovation and public outreach, to inform decision-making, educate and raise awareness, facilitate target setting, and advance cooperation. IMDOS is identified by the GPML as a key actor in providing guidance for the selection, harmonization, and use of global marine debris data.

By occupying this unique niche in the otherwise complex landscape of organizations dealing with various aspects of marine plastic pollution, we are confident that IMDOS is a fundable project. Potential sponsors and funding agencies have already been engaged, starting with the official IMDOS Kick-Off event during the UN Ocean Conference in June 2022.

Currently, the coordination of IMDOS is supported by GOOS and GEO Blue Planet with funding originating from two European Union projects: H2020 EuroSea and EU4OceanObs.

- *Potential to be repeatable / scalable / reusable*

  IMDOS can be seen as a pilot and a demonstration of how to establish an observing system fit for addressing the wider problem of marine pollution. If successfully implemented and integrated within GOOS, it should serve as a model for further expansion onto additional so-called Human Pressure EOVs – one of the strategic objectives of GOOS.

- *Engages developing countries*

  IMDOS is fully committed to building a globally equitable observing system for marine debris, recognizing that it is the developing countries that are the main stakeholders of an IMDOS which delivers timely and reliable data for science-based decision making. IMDOS aims to coordinate and support the activities of marine debris monitoring in the Global South and other developing countries especially through appropriate representation in the regional hub structure, akin to the successful model of the Global Ocean Acidification Observing Network (GOA-ON).

Interface with GOOS

As a GOOS Project IMDOS commits to reporting to the GOOS SC during its annual meetings, and as required. IMDOS has already established a close link with the GOOS Biogeochemistry Panel of Experts and in the long-term, it is foreseen that a permanent liaison function between IMDOS and GOOS Panels of Experts (Biogeochemistry and BioEco) be ensured. IMDOS has been represented at GOOS OCG meetings and it is anticipated that one of the elements of IMDOS (focused on coordinated observations of surface floating plastics) will strive to be integrated into existing OCG networks (e.g. SOOP, DBCP). With marine plastics debris being routinely collected by more and more GRAs, IMDOS would liaise with them as well. The connection is already strong with EuroGOOS, and has been initiated lately with CIOOS.

A dedicated IMDOS website (imdos.org) is currently under development and is expected to launch by September 2023 along with social media channels. The website will serve as a communication hub for the IMDOS community and will provide regular and frequent updates about status and progress of the project's development. With respect to the observing status reporting, IMDOS aims in the long-term to report through the OceanOPS Dashboard, and where relevant, the Annual Report Card, obtaining adequate human resources to strengthen the OceanOPS staff.

IMDOS Interim Steering Committee

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