LIFE24-PRE-IT-LIFE-MAPPER

Guidelines for **MAP**ping, **P**rot**E**cting, and **R**estoring Marine Ecosystems

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Executive Summary

The document is part of "WP1 - Project management and coordination" and it refers to the implementation of the LIFE MAPPER Data Management Plan (DMP) conceived as a living document, agreed upon by all consortium partners, that will be updated throughout the project lifecycle, particularly in response to significant changes in data generation, processing or management. This document represents the first version of the LIFE MAPPER DMP (Month 12) and will be continuously refined over the duration of the project. The document will be electronic in English and under CC-BY license to allow a broad re-use.

The Data Management Plan (DMP) is a key element of effective research data management. This document outlines the data lifecycle for the data to be collected, generated and/or processed within the LIFE MAPPER project, including: (i) data collection during the project; (ii) the management, description, storage and standards applied; and (iii) the handling and protection of data during and after the completion of the project.

In line with the FAIR principles (Findable, Accessible, Interoperable, Reusable) and the Open Science policies promoted under Horizon Europe, the DMP provides information on:

- the handling of research data during and after the end of the project;
- the types of data to be collected, processed and/or generated;
- the methodologies and standards to be applied;
- whether and how data will be shared, including open access provisions where appropriate;
- how data will be curated, preserved and made available for long-term reuse.

The LIFE MAPPER DMP has been developed in accordance with the Horizon 2020 FAIR Data Management Plan Template (H2020 Programme Guidelines on FAIR Data Management in Horizon 2020, Version 3.0, 26 July 2016).

The **LIFE MAPPER Data Policy** is provided as an annex to the DMP. The procedures described therein shall be followed by all consortium members and ensure that:

- data relating to human subjects are transferred and processed within secure environments;
- data use complies with all applicable ethical and legal requirements, including informed consent, ethics approvals, and the General Data Protection Regulation (EU) 2016/679 (GDPR);
- the use of both existing and newly generated data is conducted in agreement with the respective Data Owner/Data Provider.

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1 Data summary

Points to be addressed:

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- What is the origin of the data?
- What is the expected size of the data?
- To whom might it be useful ('data utility')?

1.1. What is the purpose of the data collection/generation and its relation to the objectives of the project?

LIFE-MAPPER aims to consolidate and synthesize existing knowledge, methodologies, and best practices in habitat mapping, conservation and marine restoration. This initiative is designed to enhance the capacity of stakeholders to plan and implement effective marine conservation and restoration efforts across EU seas (including the Baltic Sea and Black Sea).

In particular, LIFE MAPPER focus on the Nature Restoration Regulation (NRR) providing three main product, that will be delivered in digital format to serve a diverse range of stakeholders starting from the European Commission and the EU Member States:

• The **LIFE MAPPER Manual:** integrating fragmented data, methodologies, and best practices, enhancing knowledge and understanding about the distribution, condition, and extent of habitats and species listed in Annex II of the NRR. The manual provides targeted recommendations to close existing knowledge gaps and guide future efforts and investments in marine restoration.

• The **LIFE MAPPER Knowledge Platform**: a dynamic hub offering user-friendly navigation, searchable content and downloadable resources. With a clean, organized interface and integrated with other EU initiatives and projects, the platform will facilitate knowledge exchange and support informed decision-making. Content will be regularly updated and will include articles, datasets, and interviews to ensure the employment from users and the application of relevant information.

• The **LIFE MAPPER Geoportal**: integrating available Web Mapping Services and linking to other portals that are currently developed at European and national level.

1.2. What types and formats of data will the project generate/collect?

The LIFE MAPPER project includes a range of data types, organised according to their content and format. Spatial data consist of georeferenced information in both vector formats (e.g. shapefiles) and raster formats (e.g. GeoTIFF), complemented by OGC services (WMS, WFS, WCS), which enable the sharing and online access of geospatial data. The project also incorporates questionnaires in Excel format, designed to collect quantitative and qualitative information, as well as structured databases (e.g. Geodatabases) for efficient data storage and management. In addition, documents and scientific papers in PDF format, while interviews in audio or video formats (e.g. mp3, mp4) capture expert knowledge and stakeholder experiences.

Num.	Type of resource	Format	Description
1	Spatial data	.shp, .tif , esrigrid, .asci	Georeferenced data in vector (polygons, polylines, and points) or raster format (surfaces).
2	OGC services	Web Map Services (WMS), Web Feature Services (WFS), Web Coverage Services (WCS)	Web services compliant with Open Geospatial Consortium (OGC) standards that allow sharing and accessing geospatial data.
3	Questionnaires	.xlsx	Structured series of questions used to systematically collect quantitative and/or qualitative information from participants for filling gaps of knowledge
4	Database	.xlsx, .gdb, .gpkg, Oracle spatial	An organized system for storing, managing, and retrieving spatial and non-spatial data.
5	Documents	.pdf	All documents coming from the LIFE MAPPER reviews (e.g. description of case studies, scientific papers, technical guidelines, protocols, grey literature, scientific papers, policy briefs, etc).
6	Interview	.mp3, mp4, .avi	File video or audio with structured conversation used to collect information, experiences, or expert opinions through questions and answers.

Table 1 LIFE MAPPER data types and formats.

1.3. Will you re-use any existing data and how?

LIFE MAPPER will perform systematic reviews addressing scientific publications, grey literature, and already existing spatial data in EU Seas. For all the review, the spatial scale will be the European Seas and the targets will be the benthic habitats listed in the Annex II of the NRR.

Num.	Name
1	Systematic review of literature reporting habitat mapping
2	Systematic review of habitat mapping database
3	Review of existing case studies/projects providing available information for cost assessment across habitats
4	Review of existing case studies/projects providing available information for cost assessment across habitats
5	Systematic review of all the information gathered and criteria already applied to implement the MSFD by the different EU Countries, to identify common standards
6	Systematic review of existing GES assessment protocols (MSFD, HD), scientific research and past / on-going projects related to habitat condition assessment and favourable setting areas
7	Systematic review of existing tools and methods to identify criteria (feasibility approach and processes considering economical, historical and ecological factors) for prioritisation of mapping, conserving, and restoring the habitats of the Annex II of the NRL (e.g. EMODnet EUSeaMap, PrioritizeR, Marxan).

Table 2 LIFE MAPPER systematic reviews.

1.4. What is the origin of the data?

LIFE MAPPER will reuse data on the extent and conditions of habitats, mapping technologies and costs, and restoration measures, coming from scientific publications and grey literature (points 1 and 2 of Table 3), as well as from existing databases and repositories dealing with spatial data (point 3 of Table 3). The project will also collect data from the project consortium to retrieve unpublished data (point 4 of Table 3). Finally, LIFE MAPPER will create new information through questionnaires, workshops and interviews (points 5–7 of Table 3).

Num.	Source	Example
1	Peer reviewed scientific publications	Scopus, ISI Web of Science, Google Scholar
2	Grey literature	OpenAIRE, ResearchGate
3	Databases and repositories of spatial data	EMODnet
4	Unpublished data	LIFE MAPPER consortium
5	Questionnaires	Scientific community and competent authorities dealing with habitat mapping and restoration measures
6	Workshops	Scientific community and competent authorities dealing with habitat mapping and restoration measures
7	Interviews	Scientific community and competent authorities dealing with habitat mapping and restoration measures

Table 3 List of data sources for the LIFE MAPPER Project.

1.5. What is the expected size of the data?

The LIFE MAPPER Project expects to manage digital data for about 12 TB.

1.6. To whom might it be useful ('data utility')?

The LIFE MAPPER Project addresses the need to support EU Member States in implementing the Nature Restoration Regulation (NRR) and the Birds and Habitats Directive (BHD) in the marine environment, as well as filling knowledge gaps relating to the mapping, conservation and restoration of marine ecosystems in accordance with the Marine Strategy Framework Directive (MSFD). This includes the significant gaps represented by the need to establish appropriate criteria for spatial prioritisation and the assessment of intervention costs. The project results will be useful for:

- increasing the effectiveness of habitat mapping in order to answer the questions of where, what and how to map;

- emphasising the crucial role of accurate and extensive marine habitat maps in achieving European and international targets for biodiversity conservation, restoration and climate action;
- assessing species/habitat condition and setting favourable reference conditions for habitats and associated species;
- selecting the most effective protocols for restoration interventions for habitats and associated species, building on the substantial expertise and knowledge of the project partners and other EU initiatives;
- estimating the costs of mapping, assessing status and favourable conditions, and restoration measures;
- providing recommendations for prioritising restoration actions by describing how to integrate spatial data on habitat extent and condition, current and future pressures, potential restoration actions and costs;
- providing recommendations to overcome knowledge gaps, limitations and opportunities for better coordination across Member States to reach EU targets more efficiently.

2 FAIR data

Points to be addressed:

- In general terms, your research data should be 'FAIR' that is findable, accessible, interoperable and re-usable. These principles precede implementation choices and do not necessarily suggest any specific technology, standard or implementation-solution.

The LIFE MAPPER Project adopts a structured data management and dissemination workflow designed to ensure the collection, integration, publication, and communication of all relevant information collected and produced throughout the project. The workflow is organised around the following key steps:

1. **Data collection**, including spatial data, documents from literature reviews, interviews and questionnaires. Documents are collected and stored in a dedicated Microsoft OneDrive repository, while spatial data are stored in the ISMAR cloud infrastructure, given the size and complexity of the datasets involved.
2. **Spatial data integration** into a common and harmonised repository, specifically the ISMAR geodatabase within the ISMAR Marine Spatial Data Infrastructure (MSDI). This step ensures consistency and interoperability across all spatial datasets contributed by project partners.
3. **Data publication** through the ISMAR Geoportal and its related metadata platform, both integrated within the ISMAR MSDI. The publication process involves the integration

of available OGC web services (e.g. WMS, WFS) together with the spatial data stored in the LIFE MAPPER geodatabase, ensuring open and standardised access to the project datasets.

4. **Dissemination of project results** through the publication of the LIFE MAPPER Manual and of the LIFE MAPPER Knowledge platform. The manual provides guidelines on marine habitat mapping, conservation and restoration and will serve as a practical reference for those involved in marine ecosystem management, including practitioners, scientists and policymakers. The online knowledge platform, which was developed by Space 42, is a comprehensive and dynamic repository that aims to maximise the visibility and uptake of the project outcomes among a broad range of national and European stakeholders.

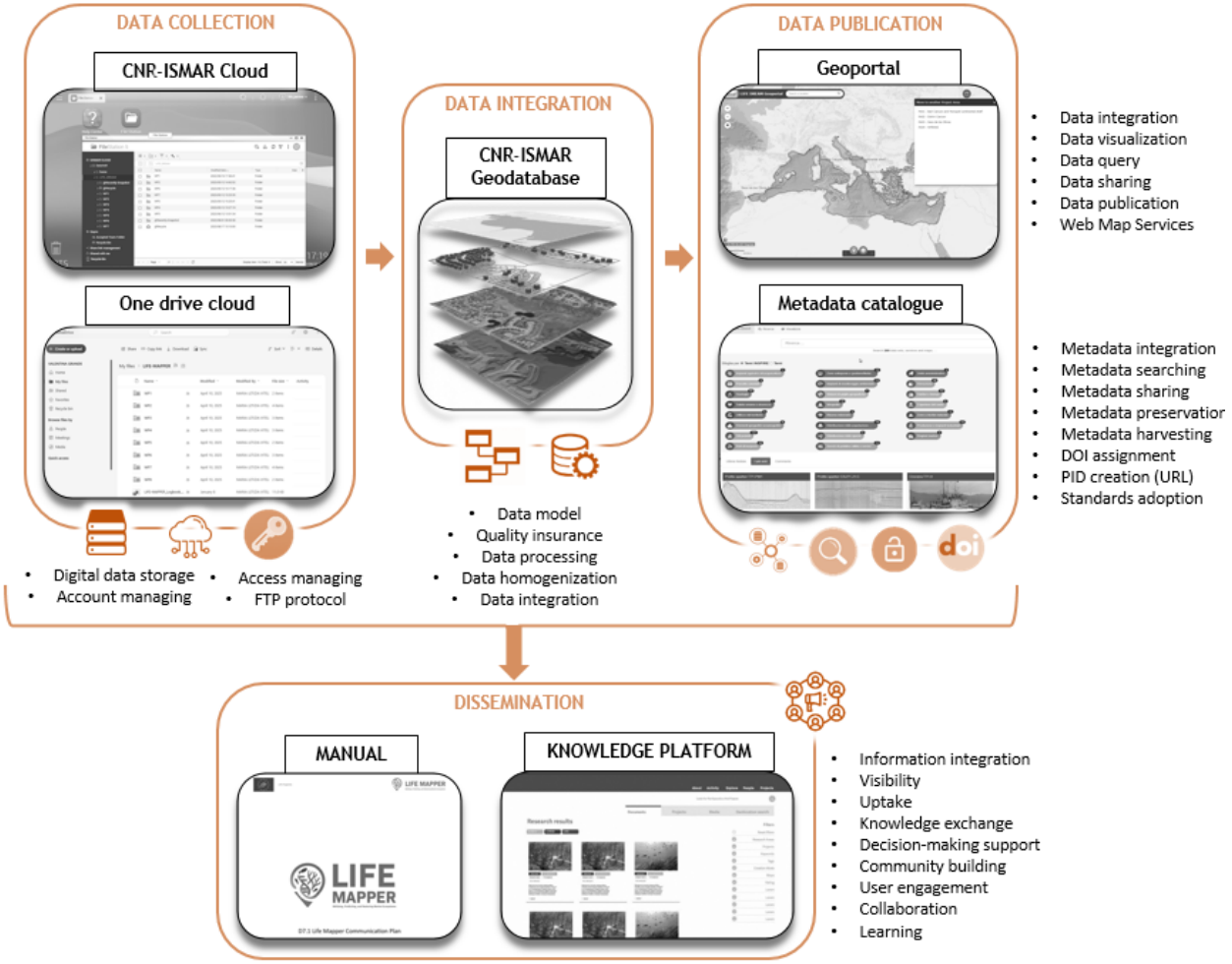

Figure 1 LIFE MAPPER data flow.

2.1. Making data findable, including provisions for metadata

LIFE MAPPER will ensure that all datasets retain a reference to their persistent identifier and are made available in accordance with the same policy specified by the source. For data that have not yet been published or do not have already associated metadata, a specific metadata record will be created with a dedicated URL and, if required, a DOI. The metadata records will be managed by a metadata catalogue that will make the datasets searchable. Project deliverables will be published in the project website but also in Zenodo to obtain a DOI and make them findable through time.

2.2. Making data openly accessible

All the metadata will be openly accessible without any restriction through the metadata catalogue, while datasets will be visible via the Geoportal and the Knowledge platform and accessible by request. Once the access has been approved, the data will be available via file download from online location (e.g. FTP). The Annex I specify the LIFE MAPPER data policy. The metadata record will be available even if the data is no longer available thanks to the metadata catalogue managed by CNR-ISMAR in its MSDI.

2.3. Making data interoperable

Metadata will be available in an open, standard and machine-readable format. In particular, the metadata records will follow the standard ISO19139 for geographic information both in term of vector datasets, raster data and web services. Metadata are readable and thus interoperable for machines without any requirements thanks to the usage of standards. The metadata records are exposed as XML with the HTTP protocol and the CSW allows other infrastructures to automatically harvest them.

Data will be organized in a Geodatabase following the INSPIRE Data Specification for spatial data (including codelists). They will be available as OGC geospatial services (WMS, WFS and WCS) allowing requests for geographical features across the web using platform-independent calls. The OGC geospatial services for the representation of the data in the geoportal, in other infrastructures or in desktop environments (e.g., ArcGIS, QGIS) are compliant with machine-understandable community standards (WMS, WFS, WCS) and available in the section Distribution of the metadata form.

Both data and metadata can be connected to other online resources through links to people (ORCIDs), scientific papers (DOIs), projects (webpages), or other meta(data) catalogues. In addition, metadata records can be connected to other digital objects described in the GeoNetwork through the element "Associated resources" defining also the role of the relationship (parent, service, source dataset, source catalogue, other resource). Today, not all

the vocabularies used in the GeoNetwork or in the Geodatabase are documented and resolvable using globally unique and persistent identifiers.

2.4. Increase data re-use (through clarifying licences)

Metadata will provide rich and accurate information, including the licence/usage rights assigned to the data. The standard (e.g. Creative Commons) licence with the licence deed URL encoded will be in a machine-readable format (XML). Metadata also will contain the reference to the LIFE MAPPER Data policy (Annex I). Metadata will also include information about the provenance of the data, such as origin, history and workflow in the Quality section. In the Geodatabase, all sources and original metadata will be maintained.

3 Allocation of resources

Points to be addressed:

- Estimate the costs for making your data FAIR. Describe how you intend to cover these costs
- Clearly identify responsibilities for data management in your project
- Describe costs and potential value of long-term preservation.

LIFE MAPPER will use an already existing MSDI built and consolidated through the years by CNR-ISMAR. The costs for maintaining the MSDI can be summarized as follow: (1) Server, Machine warranty, External service for maintenance, Cloud storage for backup, Software license for remote access (maintenance), Specific software license (ca. 30,000 EUR/YEAR); and (2) Personnel cost (ca. 20,000 EUR/YEAR).

"WP1 - Project management and coordination" led by CNR is in charge of the data management with Valentina Grande as data manager. CNR predicted 12 person-month for WP1 for a total cost of ca. 66,000 EUR. No additional costs are expected in the LIFE MAPPER for maintaining the infrastructure, CNR will capitalize the MSDI implemented in previous projects [1].

Long term data preservation and curation will be ensured thanks to the use of the CNR-ISMAR Marine Spatial Data Infrastructure (MSDI) and the inclusion of LIFE MAPPER relevant results in European repositories.

[1] Federica Foglini, Valentina Grande, 2022. A Marine Spatial Data Infrastructure to manage multidisciplinary, inhomogeneous and fragmented geodata in a FAIR perspective ... the Adriatic Sea experience. Oceanologia, Volume 65, Issue 1, 2023, Pages 260-277, ISSN 0078-3234, https://doi.org/10.1016/j.oceano.2022.11.002.

4 Data security

Points to be addressed:

- Address data recovery as well as secure storage and transfer of sensitive data

LIFE MAPPER will ensure easy data access and data recovery, as well as secure storage and transfer of the data. To ensure the security of the data, the following guidelines will be followed by Beneficiaries: 1) Store data in at least two separate locations to avoid loss of data; 2) Encrypt data if is deemed necessary by the participants; 3) Limit the use of USB flash drivers; 4) Label files in a systematically structured way in order to ensure the final dataset coherence. The data exchange between partners and data manager will be performed through the cloud platform offered by CNR to store documents and files guarantee service availability 7 days/week and 24h/day except during blocking incident, after which the service can be re-established within few hours.

Management of datasets that include personal information and health information of study participants will be compliant with the General Data Protection Regulation (GDPR, Regulation (EU) 2016/679) [2]. The GDPR is a regulation by which the European Parliament, the European Council and the European Commission intend to strengthen and unify data protection for individuals within the European Union (EU). Specific requirements for privacy and personal data protection are dealt in agreement with the document Ethics and Data protection by the European Commission [3].

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016R0679
[3]https://ec.europa.eu/info/sites/default/files/5._h2020_ethics_and_data_protection_0.pdf

5 Ethical aspects

Points to be addressed:

- To be covered in the context of the ethics review, ethics section of DoA and ethics deliverables. Include references and related technical aspects if not covered by the former

LIFE MAPPER will fully comply with the regulations set out in the GDPR, the principles of the European Charter for Researchers, the European Code of Conduct for Research Integrity, including ethical standards and guidelines, regardless country in which research is carried out. Anything in this project shall be deemed to require a party to breach any mandatory statutory law under which the

party is operating. This includes any national or European regulations, rules, and norms regarding ethics in conducting research.

All project partners are obliged GDPR to protect personal data. The coordinator of LIFE MAPPER will follow ethical guidelines in its work. Important aspects with respect to this are:

- The ethical guidelines are based on the vision of using science and technology to create a better society and are reviewed continuously to ensure they stay up to date with developments in society and the challenges of today. They generally fall into these categories: research ethics, business ethics, and ethics in interpersonal relationships.
- All partners' employees are expected to act in accordance with the ethical guidelines and principles. As coordinator of the project, CNR will ensure that any ethical issues, which may arise, will be handled appropriately and in a transparent and fair manner.

6 Other issues

Points to be addressed:

- Refer to other national/funder/sectorial/departmental procedures for data management that you are using (if any)

There are no others national/funder/sectorial/departmental procedures for data management to be described.

ANNEX I

LIFE MAPPER Data policy and License Agreement

Date: 30/04/2026

Authors: Valentina Grande, Federica Foglini (CNR-ISMAR)

LIFE MAPPER Data policy

The LIFE MAPPER Data policy is consistent with, and in the spirit of, national and international policies and laws. Applicable policies or laws are those related to UN conventions, policies of international bodies often within the UN, policies and laws of the European Union. The LIFE MAPPER Data policy is intended to be fully compatible with the European Directive 2003/4/EC on public access to environmental information [1], the European Directive 2019/1024 on open data [2] and its implementing documents [3], the INSPIRE Directive [5]. Moreover, the document follows the guidelines and standards from CODATA IDPC [6], Horizon Europe [7], and RDA [8], and more in general, the Berlin Declaration [9] and Joint Declaration of Data Citation Principles (FORCE11) [10], Open Science and FAIR principles [11].

LIFE MAPPER makes data available timely, freely and without restriction: “timely” means sufficiently rapidly to be of value for a given application, “freely” means at no more than the cost of reproduction and delivery, without charge for the data itself, and “without restriction” means without discrimination against, for example, individuals, research groups, or nationality. LIFE MAPPER makes data available in a timely and easy way to users through the Geoportal and the Knowledge platform. According to the different types of assets, the access conditions vary: 1) metadata are freely accessible without any condition through a metadata catalogue 2) data and products require acceptance of a user license.

Data access is guaranteed once the LIFE MAPPER data access request form has been signed and sent to lifemapper@ismar.cnr.it.

References

[1] Directive 2003/4/EC of the European Parliament and of the Council on public access to environmental information and repealing Council Directive 90/313/EEC.

[2] Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information.

[3] Commission Implementing Regulation (EU) 2023/138 of 21 December 2022 laying down a list of specific high-value datasets and the arrangements for their publication and re-use.

[5] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

[6] CODATA (Committee on Data for Science and Technology) International Data Policy Committee (IDPC). Last access february 2026: https://codata.org/initiatives/data-policy/international-data-policy-committee.

[7] Horizon Europe (HORIZON) Programme Guide. Last access February 2026: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_v1.4_en.pdf.

[8] Research Data Alliance. (n.d.). Scientific Legacy Data Interest Group. www.rd-alliance.org

[9] Berlin Declaration on Access to Knowledge in the Sciences and Humanities (2003). Last access February 2026: https://openaccess.mpg.de/67605/berlin_declaration_engl.pdf.

[10] Joint Declaration of Data Citation Principles. Martone M. (ed.) San Diego CA: FORCE11; 2014 Last access February 2026: https://www.force11.org/joint-declaration-of-data-citation-principles-final.

[11] Wilkinson M, Dumontier M, Aalbersberg IJ, Appleton G, Axton M, Baak A, Blomberg N, Boiten J, Santos LBdS, Bourne P, Bouwman J, Brookes A, Clark T, Crosas M, Dillo I, Dumon O, Edmunds S, Evelo C, Finkers R, Gonzalez-Beltran A, Gray AG, Groth P, Goble C, Grethe J, Heringa J, Hoen PC', Hooft R, Kuhn T, Kok R, Kok J, Lusher S, Martone M, Mons A, Packer A, Persson B, Rocca-Serra P, Roos M, Schaik Rv, Sansone S, Schultes E, Sengstag T, Slater T, Strawn G, Swertz M, Thompson M, Lei Jvd, Mulligen Ev, Velterop J, Waagmeester A, Wittenburg P, Wolstencroft K, Zhao J, Mons B, 2016. The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data 3: sdata201618-sdata201618. https://doi.org/10.1038/sdata.2016.18

LIFE MAPPER License Agreement: Terms and Conditions

1. The Licensor grants to the Licensee a non-exclusive and non-transferable license.

2. Retrieval, by electronic download, and the use of data is free of charge, unless otherwise stipulated.

3. Regardless of whether the data are quality controlled or not, LIFE MAPPER and the data source do not accept any liability for the correctness and/or appropriate interpretation of the data. Interpretation should follow scientific rules and is always the user's responsibility. Correct and appropriate data interpretation is solely the responsibility of data users.

4. Users are requested to inform LIFE MAPPER of any problems encountered with the provided data. This feedback will increase the quality of the data.

5. Users must acknowledge data sources. It is not ethical to publish data without proper attribution or co-authorship. 6. LIFE MAPPER data and products must be acknowledged using the following citation: "LIFE24-PRE-IT-LIFE-MAPPER - Guidelines for MAPping, ProtEcting, and Restoring Marine Ecosystems (101213793)".

7. LIFE MAPPER will invoke legal and technological measures to prevent and penalize copyright infringement.

8. Data users must respect any and all restrictions on the use or reproduction of data as indicated in the metadata.

9. The data cannot be used for legal, or for navigational purposes. LIFE MAPPER data or products is not meant to be used for legal, economical (e.g., exploitation of natural resources) navigational purposes or warfare-related purposes. It is developed solely for scientific, educational and research purposes.

LIFE MAPPER
MAPping, ProtEcting, and Restoring Marine Ecosystems

LIFE MAPPER Data access request form

Name and Surname:

Organization:

Project name and funding organization:

Contact Information:

Data requested:

How will the data be used? (please, provide as much information as possible concerning the purpose behind the data request and foreseen future publications)

Agree to LIFE MAPPER License Terms and Conditions

Date Signature

To be sent to: **lifemapper@ismar.cnr.it**