

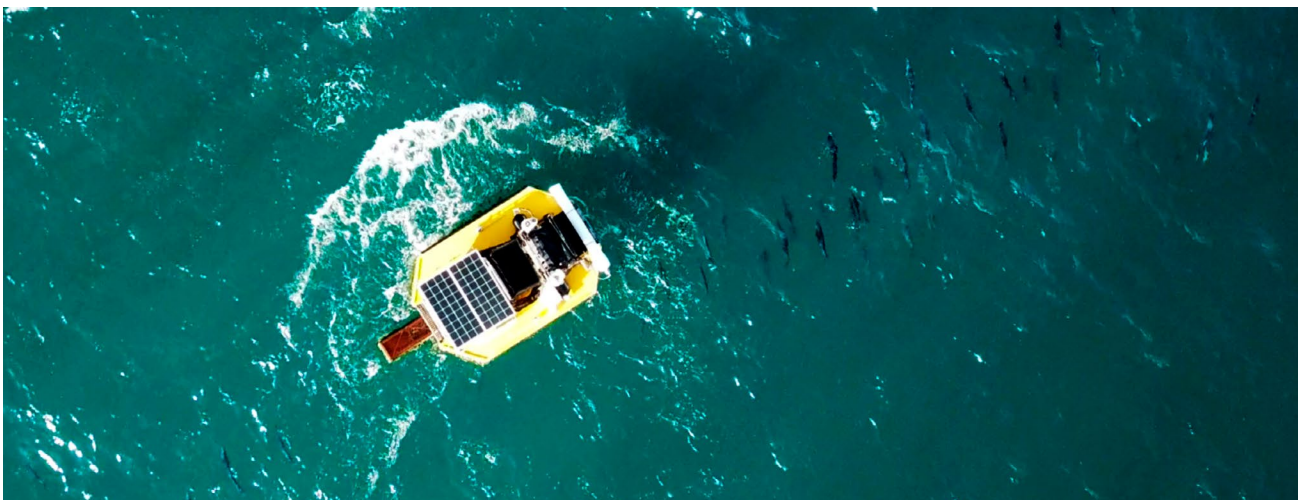


8.0

Marine Renewable Energy Data and Information Systems

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As the marine renewable energy (MRE) sector grows, large amounts of environmental and technical data and information are being collected. When these data and information are openly available, they can be used to guide research and development, inform responsible siting and consenting of projects, and increase stakeholder understanding through transparency. For example, quality environmental data collected during the siting, consenting, construction, operation, and decommissioning of MRE projects can all play key roles in better characterizing baseline conditions, developing effective monitoring and mitigation strategies, and retiring environmental risks through data transferability (see [Chapter 6](#)). Ensuring that these data and information are easily discoverable and accessible will help the MRE sector make informed decisions and coexist in an increasingly busy ocean environment.



Data and information systems, such as data repositories, data portals, and geospatial data platforms, play key roles in data management, stewardship, and use. Some systems host raw and/or derived data products, while others may include analyzed and interpreted information, data processing features, modeling and software tools, visualizations, mapping interfaces, and/or educational content. This chapter highlights several of the data and information systems focused specifically on MRE research, development, and deployment around the world, as well as other marine and environmental data systems that may be applicable to the MRE sector.

8.1. MRE DATA AND INFORMATION SYSTEMS AROUND THE WORLD

Several national and international data and information systems host and disseminate data and information relevant to MRE development in a variety of formats.

8.1.1. INTERNATIONAL SYSTEMS

The Portal and Repository for Information on Marine Renewable Energy (PRIMRE) is the centralized system for MRE data, information, and resources in the United States, much of which is relevant to the international MRE community. PRIMRE is primarily made up of seven knowledge hubs (Figure 8.1), each with its own unique structure and purpose: the Marine and Hydrokinetic Data Repository (MHKDR) hosts datasets, Tethys hosts environmental documents, Tethys Engineering hosts technical documents, the Marine Energy Projects Database hosts information on deployment activities, Marine Energy Software hosts relevant software, the Marine Energy Atlas hosts geospatial data, and Telesto hosts development guidance. PRIMRE also hosts a variety of additional tools and resources intended to support the international MRE community, including an events calendar, educational content, archived webinars, a free-use photo library, and an online newsletter. Finally, PRIMRE links to international MRE data systems to encourage data sharing for universal and transparent access around the world.

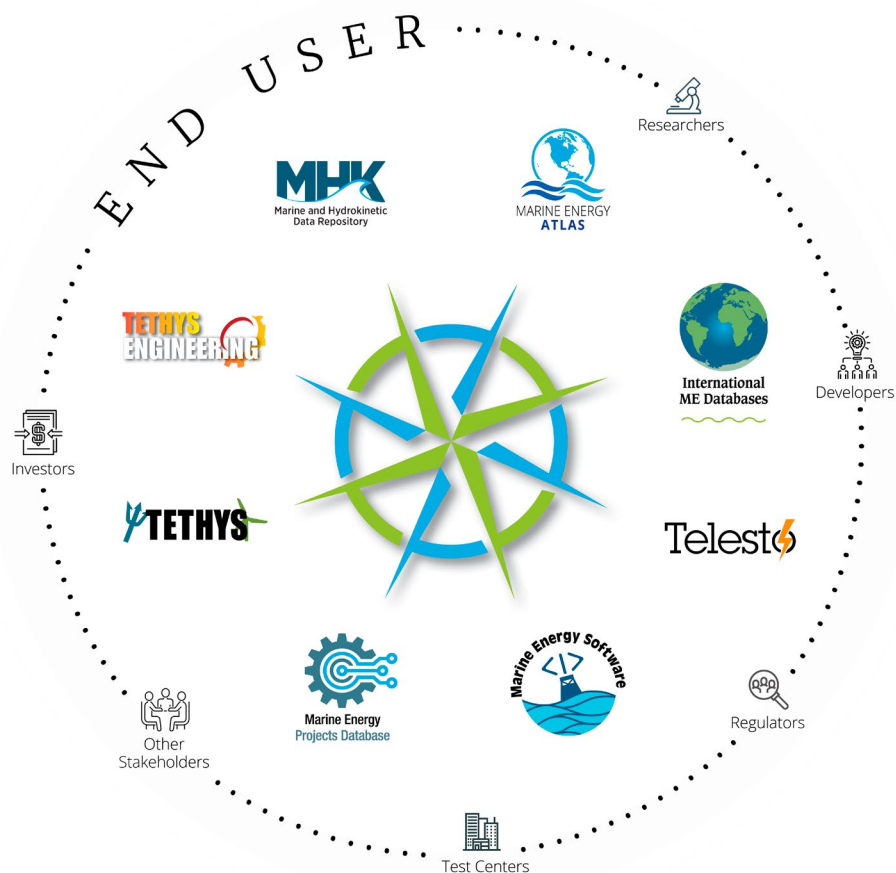


Figure 8.1. Graphic depicting the Portal and Repository for Information on Marine Renewable Energy (PRIMRE), its knowledge hubs, and their relation to relevant user groups.

Within PRIMRE, information and resources about the environmental effects of MRE development are hosted on Tethys (Figure 8.2). The Tethys Knowledge Base is a comprehensive collection of documents, including journal articles, scientific reports, and conference papers, that cover a range of environmental topics, such as underwater noise effects on marine mammals and fish collision risk with tidal turbines. The documents can be easily filtered, searched, and sorted, to provide an understanding of different areas of MRE research. Another key feature is the Tethys Blast online newsletter, which provides bi-weekly updates on new publications in Tethys, upcoming events, funding and employment opportunities, and international news relevant to the MRE sector.

Tethys also serves as a collaborative space and dissemination platform for the Ocean Energy Systems (OES)-Environmental initiative (see Chapter 1)—a collaboration among 16 countries dedicated to studying the environmental effects of MRE development around the world. To improve understanding and support efficient project consenting, OES-Environmental synthesizes available data and information and develops publications, online tools, and other resources for different stakeholder groups. For example, OES-Environmental has published a series of Guidance Documents that can be used to evaluate the environmental, social, and

economic effects of MRE within a general regulatory context (see Chapter 6). Tethys also features a variety of educational resources that can be used by students of all ages and educational backgrounds, including coloring pages, animated videos, and an interactive video game: Marine Energy Adventure: Collision Risk (see Chapter 7).

OES-Environmental also collects information, or metadata, about many of the activities around the world that are examining the potential environmental effects of MRE devices through monitoring or research. Each Marine Energy Metadata page provides detailed information about the MRE project or research study, including its scope, methods, and results, as well as links to available publications and monitoring reports. The metadata forms were used to examine environmental effects activities around the world (see Chapter 2). Similarly, the Monitoring Datasets Discoverability Matrix is an interactive tool that allows regulators, developers, and the larger MRE community to easily discover datasets from already consented projects that can be used to aid consenting processes for future MRE projects. By making this information widely available, OES-Environmental aims to enhance transparency around environmental monitoring efforts to advance the global state of knowledge and the industry in an environmentally responsible manner.



Figure 8.2. Graphic depicting Tethys, an online knowledge hub with information and resources on the environmental effects of marine renewable energy and wind energy globally. Tethys is one of seven PRIMRE (Portal and Repository for Information on Marine Renewable Energy) knowledge hubs.

Another key international MRE data system is [MAREN-DATA](#), a dedicated data platform that hosts environmental monitoring and resource characterization data collected through the Streamlining of Ocean Wave Farms Impact Assessment ([SOWFIA](#)), Strategic Environmental Assessment of Wave energy technologies ([SEA Wave](#)), Wave Energy in Southern Europe ([WESE](#)) projects, and Streamlining the Assessment of Potential Effects of Wave Energy ([SafeWAVE](#)). The platform features datasets from many of the major MRE test sites throughout Europe, including the Biscay Marine Energy Platform ([BiMEP](#)) in Spain and the European Marine Energy Centre ([EMEC](#)) in Scotland. Available data from the test sites include underwater noise data and video capturing seabed ecology and species behavior.

The [European Biofouling Database](#), developed as part of the [OCEANIC](#) project, provides data and information about challenging biofouling species throughout Europe, including non-native species associated with MRE and related marine equipment. The database provides data and information on the occurrence of fouling species and key biofouling parameters, such as thickness and weight, to support the MRE industry in understanding the biofouling communities their devices are more susceptible to at a given site and to facilitate informed decision-making (Vinagre et al. 2020).

8.1.2. NATIONAL SYSTEMS

AUSTRALIA

The [Australian Marine Energy Atlas](#), hosted on NationalMap, provides interactive maps of Australia's wave and tidal energy resources and additional information on supporting infrastructure and spatial constraints in the marine domain, such as ports and shipping routes, fisheries and aquaculture, and marine and coastal parks. Building on prior assessments, the Atlas compiles outputs from several projects, including the Australian Wave Energy Atlas Project and the Australian Tidal Energy ([AUSTEn](#)) project.

CANADA

The [Marine Energy Resources Atlas Canada](#) is a web-based geospatial data application developed by National Research Council Canada to assist MRE stakeholders with preliminary site selection and feasibility investigations in the rivers and coastal waters in western Canada. The Atlas can investigate scenarios with different resource, socio-economic, and environmental criteria and support decision-making for MRE.

FRANCE

The French Resource Center for Offshore Renewable Energy ([RESCORE](#)) is an online platform that provides access to information relevant to the offshore renewable energy sector in France, including environmental and physical data, reports, and recommendations. The platform initially focused on the results derived from France Énergies Marines' research and development projects but is gradually taking in data from other MRE stakeholders and projects, including [DTOceanPlus](#).

[RESOURCECODE](#) is a marine data toolbox with modeling and software tools that enable resource characterization and allow wave and tidal technology developers and supply chain companies to improve designs and optimize operations. The toolbox uses laboratory data, existing models, satellites, and the extensive [MetOcean](#) datasets held by test sites, creating the highest resolution wave model in North West Europe.

IRELAND

[Ocean Energy Ireland](#) provides access to marine data, maps, tools, funding, and information relevant to MRE site assessment, development, and management in Ireland. The platform hosts a comprehensive inventory of environmental, social, and economic data relevant to all offshore renewable energy developments in Irish waters, including data from the Atlantic Marine Energy Test Site and Galway Bay Test Site.

UNITED KINGDOM

In the United Kingdom (UK), [Marine Data Exchange](#) stores, manages, and disseminates marine industry data from across England, Wales, Northern Ireland, and Scotland, including all the offshore survey data that seabed lessees and other stakeholders are required to submit to The Crown Estate and Crown Estate Scotland. The platform hosts environmental, social, and physical data from a variety of industries, including MRE, offshore wind, and subsea cables, as well as data from research projects.

The [UK Atlas of Marine Renewable Energy](#) is a free online geographic information system (GIS) interface that provides publicly available data about waves, tides, and winds in UK waters. Unique exploration tools are available to complement the resource maps and enable a greater understanding at site selection.

8.2. OTHER RELEVANT DATA AND INFORMATION SYSTEMS AROUND THE WORLD

In addition to the MRE sector-specific data and information systems detailed in the previous section, there are many regional, national, and international systems focused more generally on marine data that may also be relevant to MRE development and better understanding of its environmental effects.

8.2.1. INTERNATIONAL SYSTEMS

The European Marine Observation and Data Network (EMODnet) is a network of organizations that provides access to European marine data across seven discipline-based themes, including biology, human activities, and seabed habitats. All data is freely available, and the [European Atlas of the Seas](#) displays numerous data layers provided by the EMODnet thematic portals.

Copernicus Marine Service, part of the European Union's Copernicus Programme, aims to boost the blue economy across all maritime sectors by providing free data and information about the state of the oceans on a global and regional scale. The [Copernicus Marine Data Store](#) offers different types of marine data, information, and services, ranging from oceanographic data to educational content.

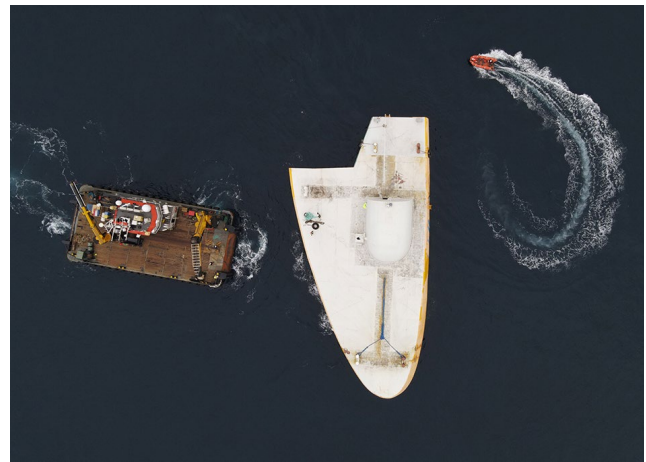
8.2.2. NATIONAL SYSTEMS

CANADA

The [Canada Marine Planning Atlas](#) is an interactive mapping tool for decision-makers and other users to access and discover geospatial data layers relevant to ecological processes, bioregion features, and human activities in Canada's marine spatial planning areas. The Atlas is supported by Fisheries and Oceans Canada and divided into the [Atlantic Atlas](#) and [Pacific Atlas](#).

FRANCE

[GéoLittoral](#) disseminates information and geographical data on maritime spatial planning and the marine and coastal environments in France. GéoLittoral's planning portal maps data are produced as part of the implementation of public policies supported by French ministries, including MRE data.



[Milieu Marin France](#) facilitates the sharing and dissemination of public data and information on the marine environment using a centralized system that pulls from multiple national and regional portals. Its Marine Environment Information System (SIMM) provides data related to sustainable development in the marine environment.

[Sextant](#) is another geographic data system that documents and disseminates a catalogue of data related to the marine environment in France, including key regulations, habitats, and species. The geographical data present on Sextant stems from research projects at the French Research Institute for Exploitation of the Sea (IFREMER) and its partner laboratories.

IRELAND

The Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR), Ireland's national seabed mapping program, delivers freely available, high-resolution seabed imagery derived from multibeam echosounder data in the Irish Exclusive Economic Zone. The [INFOMAR Marine Data Download Portal](#) provides bathymetry, backscatter, and sub-bottom data.

UNITED KINGDOM

The Marine Environmental Data and Information Network (MEDIN) aims to improve access to and management of UK marine environmental data and information. MEDIN delivers data through a network of accredited Data Archive Centers, accessible via the [MEDIN Portal](#). MEDIN also provides metadata standards and established data guidelines to assist with consistent data collection and archiving across the UK.

Marine Scotland's [National Marine Plan Interactive \(NMPi\)](#) is an online tool and data portal that enables access to spatial information relating to marine envi-

ronment and activities in Scotland. Developed to support national and regional marine planning, the interactive tool builds upon Scotland's Marine Atlas.

UNITED STATES

The National Oceanic and Atmospheric Administration's (NOAA's) [National Centers for Environmental Information](#) (NCEI) provides access to global coastal, oceanographic, geophysical, climate, and historical weather data in a variety of formats. NCEI develops software, application programming interfaces (APIs), visualization methods, and other services to enhance data access, discovery, and interoperability.

Supported by NOAA and the Bureau of Ocean Energy Management, [Marine Cadastre](#) works with national, regional, and state partners to develop and provide direct access to the best available data and tools to meet the growing needs of the blue economy. Data are shared in real time with partners, including regional ocean data portals and other data sharing platforms, and regulatory agencies for use when siting MRE deployments.

8.3. RECOMMENDATIONS

There are several regional, national, and international systems that store, organize, and disseminate the data and information needed to advance MRE development in an environmentally responsible manner. Many of the governments and organizations behind these systems are making concerted efforts to assure that their data and information are high quality and FAIR—findable, accessible, interoperable, and reusable—in accordance with the FAIR principles for scientific data management and stewardship (Wilkinson et al. 2016).

Whenever possible, environmental data should be made openly available to be freely used, re-used, and shared by anyone for any purpose. If data cannot be made openly available, clear metadata should be made available to the public to promote their discovery and provide owners' contact information. Open data can hold immense value, particularly for newly developing sectors like MRE, so enabling efficient and effective data sharing should also be a priority for everyone from data managers and researchers to regulators and industry. The development and adoption of international data

standards could further support the collection and sharing of high quality and comparable data around the world. When MRE data and information are openly available and easily discoverable by all audiences, they can be used to innovate within the MRE sector, inform other ocean uses, and help answer environmental research questions of interest to the broader scientific community.

Ensuring the longevity of data and information gathered within the MRE sector is also paramount for reducing duplication, sustaining progress, and fostering collaborative advancements. Since project financing has a finite duration, the preservation of data is critical. It is likely that key environmental datasets have already been lost, each of which could have helped address priority gaps and uncertainties. Establishing long-lasting data sharing initiatives is not only a commitment to transparency but also a strategic investment in the collective knowledge base of the international MRE community.

8.4. REFERENCES

Vinagre, P. A., Simas, T., Cruz, E., Pinori, E., and Svensson, J. (2020). Marine biofouling: A European database for the marine renewable energy sector. *Journal of Marine Science and Engineering*, 8(8), 495. doi:10.3390/JMSE8070495. <https://tethys.pnnl.gov/publications/marine-biofouling-european-database-marine-renewable-energy-sector>

Wilkinson, M. D., Dumontier, M., Aalbersberg, Ij. J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J.-W., da Silva Santos, L. B., Bourne, P. E., Bouwman, J., Brookes, A. J., Clark, T., Crosas, M., Dillo, I., Dumon, O., Edmunds, S., Evelo, C. T., Finkers, R., ... Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data*, 3, 60018. <https://doi.org/10.1038/sdata.2016.18>

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