Deloitte.

INFOMAR Programme Review

A report commissioned by INFOMAR
October 2024

Disclaimer

Deloitte Ireland LLP ("Deloitte") was commissioned by INFOMAR programme partners Geological Survey Ireland, the Marine Institute and the INFOMAR Programme Board in line with the terms set out in our Service Contract dated 29th May 2024 (the "Contract"). This document, which has been prepared by Deloitte, is for the sole purpose of providing an INFOMAR Programme Review, in line with the Review Requirements set out below.

This INFOMAR Programme Review is expressly not an audit. The review process and procedures applied are focused on a performance assessment only, and no assurance provisions can be drawn from the outcomes noted. Deloitte Ireland LLP has relied on data and analysis furnished by management of INFOMAR, the Marine Institute & Geological Survey Ireland, without audit or verification procedures being applied. To the degree that errors or material omissions in the provision of this relevant data and analysis has occurred, it could alter the results set out herein.

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Review Requirements

This INFOMAR Programme Review was undertaken in line with the following requirements as set out in our Service Contract dated 29th May 2024:

a. Review the INFOMAR programme background, aims & objectives.
b. Assess the current project achievements and status relative to targeted completion at the end of 2026.

In undertaking a) and b), include a review of INFOMAR public and corporate governance documentation, and undertake stakeholder engagement.

c. Any other activity that Deloitte considers will support achieving the overall requirements above.

Fieldwork and review timing

The Programme Review assignment has been completed between June and August 2024. Our Programme Review methodology included an extensive review of key documentation supplied by management, stakeholder and Board member interviews, and a series of structured workshops during the timeframe.

Acknowledgements

Deloitte Ireland LLP would like to thank all representatives from the sponsoring agencies and their partners as well as the extensive list of stakeholders who engaged with us in support of this Programme Review.

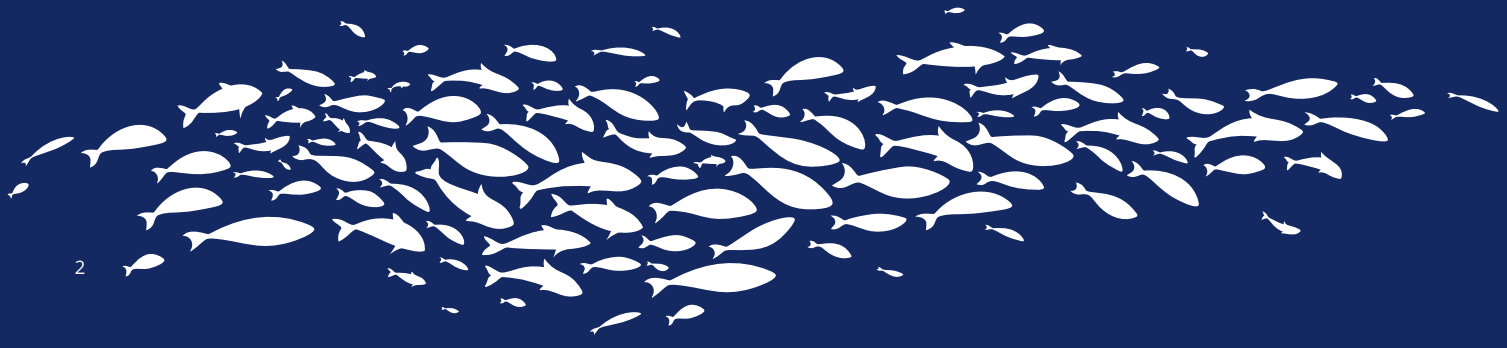
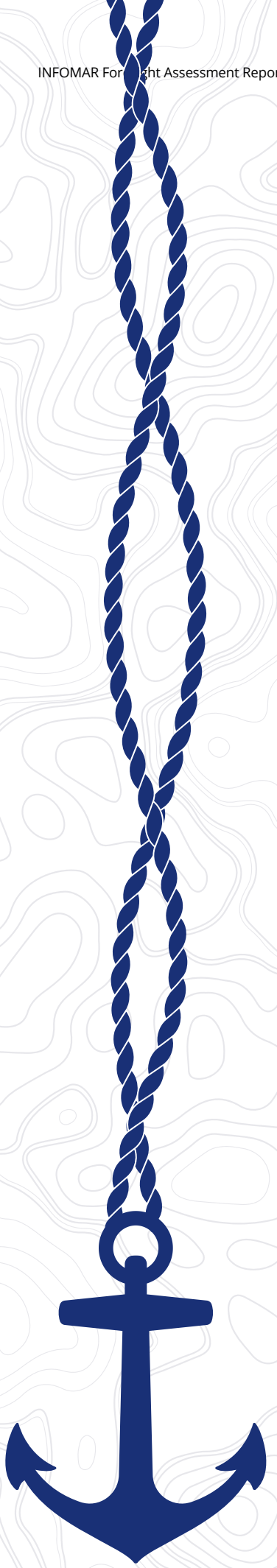
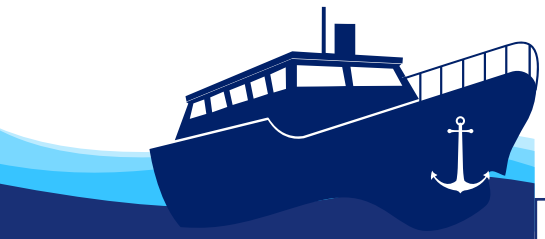


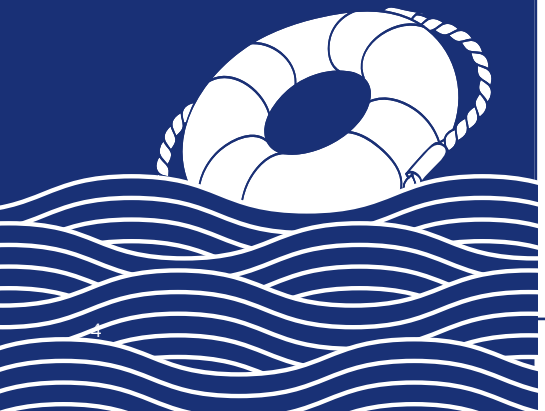
Table of Content



1. Executive Summary



IMPORTANT: This independent Foresight Assessment report (2024) was commissioned by Deloitte in parallel to the separate INFOMAR Programme Review report (2024) also commissioned and published by Deloitte Ireland LLP. The reports are designed to be complementary and can be read in sequence starting with the INFOMAR Programme Review report herein referred to simply as the Programme Review. The Programme Review will be referenced throughout the Foresight Assessment



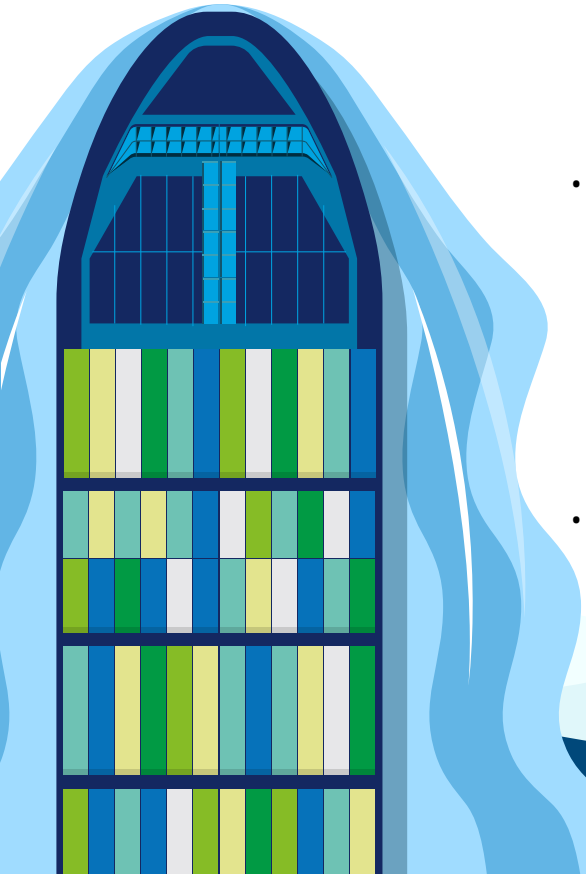
The INFOMAR programme plays a role in Ireland's marine strategy, providing critical data that informs decision-making, supports regulatory compliance, and facilitates the growth of Ireland's blue economy. Established with the goal of mapping the entire Irish seabed, the programme contributes to numerous sectors, including fisheries, environmental protection, marine spatial planning, and offshore renewable energy (ORE). As at the end of 2024, INFOMAR has demonstrated marine sector wide impact, and made significant progress, with 81% of the target area mapped, however it faces a range of challenges in achieving its 100% seabed mapping coverage by end 2026.

One of the primary challenges facing INFOMAR is the growing demand for marine survey data from various government stakeholders across the public sector, industry, academia and the public. Bodies such as the Marine Area Regulatory Authority (MARA), An Bord Pleanála, and County Planning Authorities need accurate, up-to-date marine data to support their decision-making processes and ensure compliance with environmental and regulatory mandates. The need for new marine data is increasing, and while the programme has proven to be agile and dynamic in supporting evolving stakeholder requirements, meeting the growing demands with current resources and personnel is becoming increasingly challenging. Therefore, it is important to reassess programme resourcing and personnel requirements to maximize efficiency and capacity in addressing this expanding need.

A significant gap exists in the availability of skilled professionals to carry out the required surveys and data processing, due to the lack of a formal hydrographic training programme in Ireland, and international demand for these skills. Irish professionals must seek international education and certification, or be trained in basic functions on the job by existing INFOMAR personnel. Otherwise, contracted support must be brought in from abroad. Moreover, due to the broad programme remit and increasing stakeholder interest, INFOMAR's wider team faces resource constraints, with personnel often performing multiple roles, including data management, programme coordination, outreach and administrative tasks, while also engaging in field operations

The programme's data products, while invaluable to various sectors, are not accessible immediately post-acquisition for Safety of Navigation due to the requirement for third-party sign-off from the United Kingdom Hydrographic Office (UKHO). This adds a layer of complexity and lead-time to the data transformation process, hindering INFOMAR's ability to produce the new S100 format navigation charts. There is a pressing need in particular for greater hydrographic and benthic habitat mapping expertise, as well as a robust training infrastructure to meet the growing demands of marine survey & monitoring activities, and data integration and dissemination policy related obligations.

Despite these challenges, INFOMAR continues to make significant contributions to Ireland's legal and environmental obligations, providing open-source data to the public and maintaining high standards of data quality. However, stakeholders have pointed out that, due to the prioritization of survey operations and mapping completion, INFOMAR currently lacks the capacity to implement a dedicated, proactive stakeholder-wide dissemination programme to maximise the uptake and impact of its data, products, and services. Resource allocation for engaging stakeholders on data use, potential, and overcoming barriers to utilisation remains an ongoing challenge. Developing a strategic, customer-focused outreach and engagement plan will be essential to fully realise the impact of INFOMAR's outputs across the marine economic sub-sectors.



Looking forward, INFOMAR's stakeholders are aligned in their recognition of the importance of completing the seabed mapping coverage by 2026. However, there is a growing recognition that achieving this target will require increased resources and possibly a shift in the programme's governance. With data acquisition completion rates of approximately 6% per annum being achieved under current economic circumstances, survey coverage is anticipated to increase from 81% to 93% by end 2026, with data integration and dissemination, and approximately an additional 7% of mapping coverage outstanding thereafter.

Given the complexity of the tasks involved and the limitations of the current staffing model, there is a need to explore options for extending the mandate or transitioning the programme to a new phase. This could involve a shift to a more sustainable, integrated, long-term approach to marine survey & monitoring activity, with a focus on maintaining and updating the data and continuing to support government initiatives related to marine development and policy.

- **Timeline and Resources:** A comprehensive assessment of the schedule and cost is needed to determine the feasibility of achieving the 100% seabed mapping goal by 2026. Consideration should be given to increasing survey and processing efforts or extending the timeline.
- **Transition Strategy:** As the 2026 deadline approaches, INFOMAR should plan for a transition phase to ensure the continuity of marine survey & monitoring activities. A strategic study is needed to determine the best approach for the post-INFOMAR phase, which may include expanding the programme's objectives or transitioning responsibilities to other government bodies or the private sector.
- **Staff Retention and Training:** The programme faces risks related to staff attrition, with a significant portion of its technical staff seeking more secure employment opportunities. To ensure INFOMAR's successful completion, it is critical to implement transition strategies, including retention plans, training, and knowledge transfer initiatives. Collaboration with educational institutions to address marine skills gaps should also be prioritised.
- **Data Dissemination and Stakeholder Engagement:** INFOMAR should explore new partnership models for its dissemination efforts, shifting from passive data provision to proactive data promotion. Enhanced engagement with existing and potential data consumers will help maximise the utility of the data and open up further funding opportunities.
- **Economic Impact Assessment:** An economic impact assessment should be conducted to better understand INFOMAR's role in supporting Ireland's marine economy, especially in rural and coastal areas, and its contribution to policy objectives such as sustainable fisheries and offshore renewable energy.
- **Technological Advancements:** To address the hydrographic data processing backlog and future benthic habitat mapping data analytics requirements, INFOMAR should continue coordinating AI-driven data processing research and innovation. This would help reduce processing lead times and ensure the programme remains at the forefront of technological innovation in marine mapping.

The INFOMAR programme is widely regarded as a key driver of Ireland's future blue economy. Its infrastructure, scientific outputs, and alignment with global sustainability and governance goals have established Ireland as a leader in marine research and innovation. While the programme faces several challenges, including resource constraints and staffing shortages, it remains a cornerstone of Ireland's marine policy.

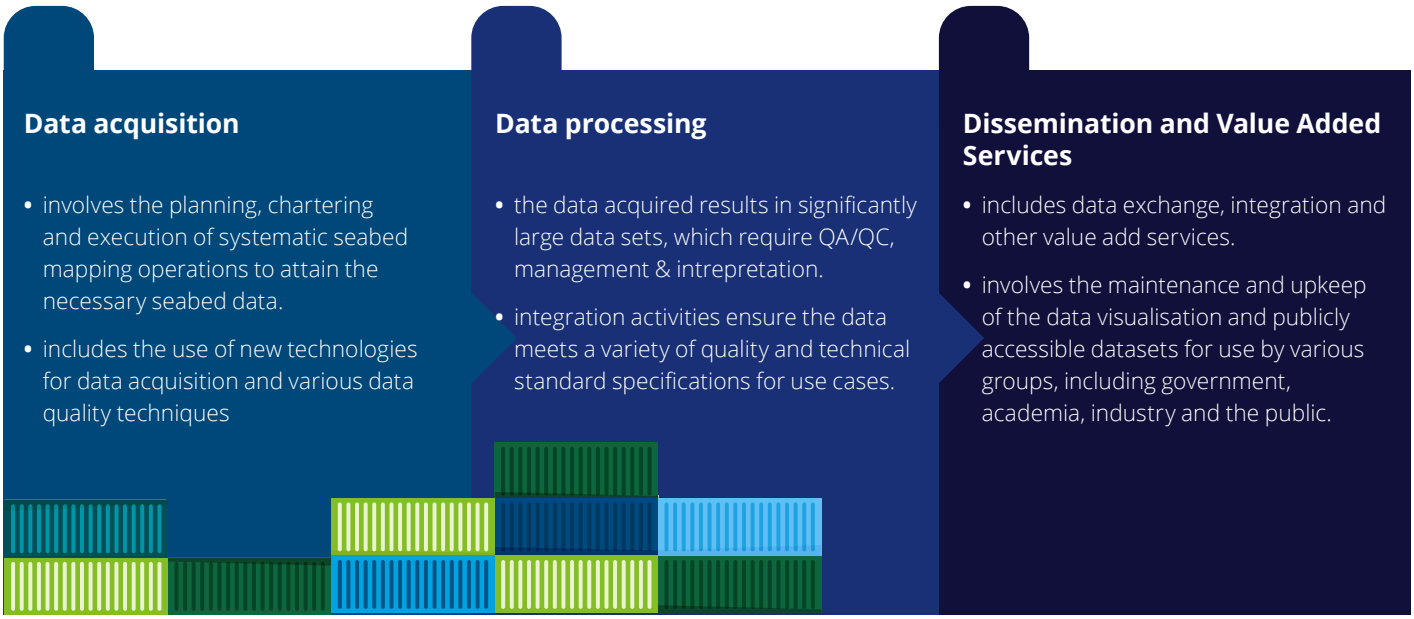
2. Introduction: What is INFOMAR?

INFOMAR is the established label or brand for the programme to pursue "**IN**tegrated **M**apping **FO**r the Sustainable Development of Ireland's **MA**rine **R**esource". This programme was initiated in 2006. The programme aims to provide high-resolution seabed maps and integrated marine data to support sustainable development, resource management, and environmental protection. The programme was split into two phases:

- Phase I (2006-2016) which focused on mapping 26 priority bays and three coastal areas; and
- Phase II (2016-2026) aims to finish the unmapped coastal and mid-water areas by 2026.

The programme is carried out by a core team of specialised technical personnel, with minimal redundancy or skills overlap between roles and is jointly managed on behalf of the Department of Environment, Climate and Communications (DECC) by the Marine Institute (MI) and Geological Survey Ireland (GSI) (See Appendix 3 for a summary of the key personnel on the programme). The programme works and builds upon the Irish National Seabed Survey (INSS), which was conducted between 1999 and 2005.

INFOMAR is structured around the following three pillars:



2.1 INFOMAR primary objective

INFOMAR's primary objective is to develop a comprehensive high-resolution, accurate, and integrated dataset covering Ireland's entire maritime area. As such, the programme is formally assessed under a single objective: the percentage of Ireland's seabed that has been comprehensively mapped and surveyed as measured in square kilometres surveyed. For the avoidance of doubt, "mapped and surveyed" in this context includes the physical activity, but also the data processing and dissemination activity to make the maps available for their intended stakeholder use cases. As outlined in Appendix III, INFOMAR as a programme is led by two programme managers and is delivered by a core group of specialist technical experts.

3. Performance assessment (to December 2023)

3.1 Primary objective performance

To carry out its seabed mapping activities, the INFOMAR programme employs eight vessels, ranging from small inshore craft to larger ships capable of operating in deeper waters for over 35 days without resupply. As of the end of 2023, INFOMAR has successfully mapped 81% of the gross seabed coverage and 75% of the net coverage. The discrepancy between gross and net coverage reflects the required overlap between successive survey campaigns and any requirement to re-survey certain areas for quality control or quality assurance purposes.

To achieve 100% coverage by 2026, INFOMAR still needs to acquire an additional 24,026 km² of seabed data (Furey & Cullen, 2023) with respect to the end 2023 coverage status and figures forming the basis of the review. The progression of mapping efforts over time, for both gross and net coverage, is detailed in Table 1 below. Preliminary figures for 2024 coverage indicate that 19% of Net coverage remains to be mapped, with 6% presently being achieved per annum.

Table 1:

Year	INFOMAR Annual Targets km² *	Gross Coverage Delivered km²	NET Coverage Delivered km²	Gross Cumulative Coverage km²	Net Cumulative Coverage km²	Target % Complete By Year km²	% Complete Gross	% Complete Net
2016	n/a	5,152	4,753	41,163	38,048	n/a	33%	30%
2017	n/a	5,322	5,193	46,485	43,241	n/a	37%	35%
2018	8,871	11,627	11,133	58,111	54,374	44%	46%	43%
2019	8,950	10,072	9,146	68,183	63,520	51%	55%	51%
2020	8,461	9,757	9,032	77,940	72,552	58%	62%	58%
2021	9,340	8,482	7,847	86,422	80,399	66%	69%	64%
2022	8,857	5,673	5,399	92,095	85,798	73%	74%	69%
2023	9,782	8,888	8,238	100,983	94,036	81%	81%	75%
2024	8,370	7,010*	6,582*	107,993*	100,618*	87%	87%*	81%*
2025	7,404					93%		86%
2026	8,463					100%		91%

* In 2018, the annual targets for the programme were set. 2024 coverage figures presented* are preliminary and may be subject to minor adjustment on completion of data processing and integration.

A trend analysis reveals significant progress and positive variances from 2018-2020, however this momentum was impacted by the 2020 Covid-19 pandemic, and thereafter by continued fuel and energy price inflation and adverse weather conditions, and more recently by the prioritisation of vessel assignment to other government initiatives.

From 2018 to 2023 the GSI and the MI ships were assigned to the INFOMAR programme for a total of 3,248 days (Furey & Cullen, 2023):

Table 2: Charter Days per Year

Vessel	2018	2019	2020	2021	2022	2023	Total
CV (RV Celtic Voyager)	76	82	48	78	55	-	339
CE (RV Celtic Explorer)	22	19	34	16	-	-	91
TC (RV Tom Crean)	-	-	-	-	26	85	111
KRY (RV Keary)	207	32	57	143	81	125	645
GEO (RV Geo)	173	61	56	133	-	-	423
MAL (RV Mallet)	186	65	55	111	119	81	617
LIR (RV Lir)	198	109	70	139	90	128	734
GAL (RV Galtee)	-	-	-	58	100	127	285
COR (MV Cosantoir Bradan)	3	-	-	-	-	-	3
Aggregate charter days	**865**	**368**	**320**	**678**	**471**	**546**	**3,248**

The programme operates under an annual budget that is not adjusted for inflation. This approach led to reduced activity levels in 2022 and 2023, particularly as input costs rose significantly. In 2023, survey coverage was notably lower than pre-COVID annual averages, despite an increase in the financial allocation for that year. This decline can be attributed to escalating operational costs, primarily driven by higher fuel prices and contract survey personnel expenses, which are expected to continue until the programme's completion.

Table 3: Annual & Total Programme Target vs. Actual Expenditure

Year	Target Spend (€millions)	Actual Spend (€millions)	Variance (%)
2006	4.00	6.16	154.0%
2007*	4.00	4.20	105.0%
2008*	4.00	3.90	97.5%
2009*	3.40	3.40	102.9%
2010*	3.00	3.00	100.0%
2011	2.90	2.90	100.0%
2012*	3.00	3.00	100.0%
2013	3.00	2.99	100.0%
2014	3.00	3.01	99.7%
2015	2.95	2.98	100.2%
2016	3.00	3.18	101.0%
2017	4.00	4.22	106.0%
2018	4.00	4.17	105.5%
2019	4.00	4.01	104.3%
2020	4.00	4.04	100.3%
2021	4.00	3.78	101.0%
2022	4.00	4.15	94.5%
2023	5.00	4.91	103.8%
2024	5.00		98.2%
2025	4.00		
2026	4.00		
Total	**78.25** [1]	**To end 2023 - 68.00**	

* Extracted Target & Actual Spend from 2013 PwC Interim Evaluation Study of the INFOMAR Programme report and relevant Board reports.

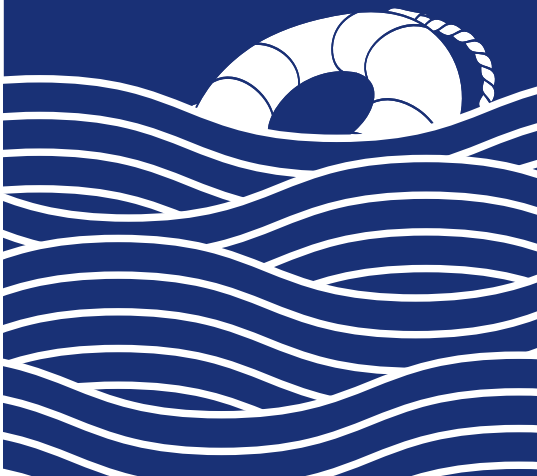
[1] In the PWC Project Evaluation the original budget for the project was €84 million over a 20-year period. The document is available at Microsoft Word - PwC Infomar Evaluation _Final_.docx

Conclusion on primary objective to end of 2023:

All evidence furnished for this review indicate that INFOMAR has tracked positively to its primary objective to the end of 2023.

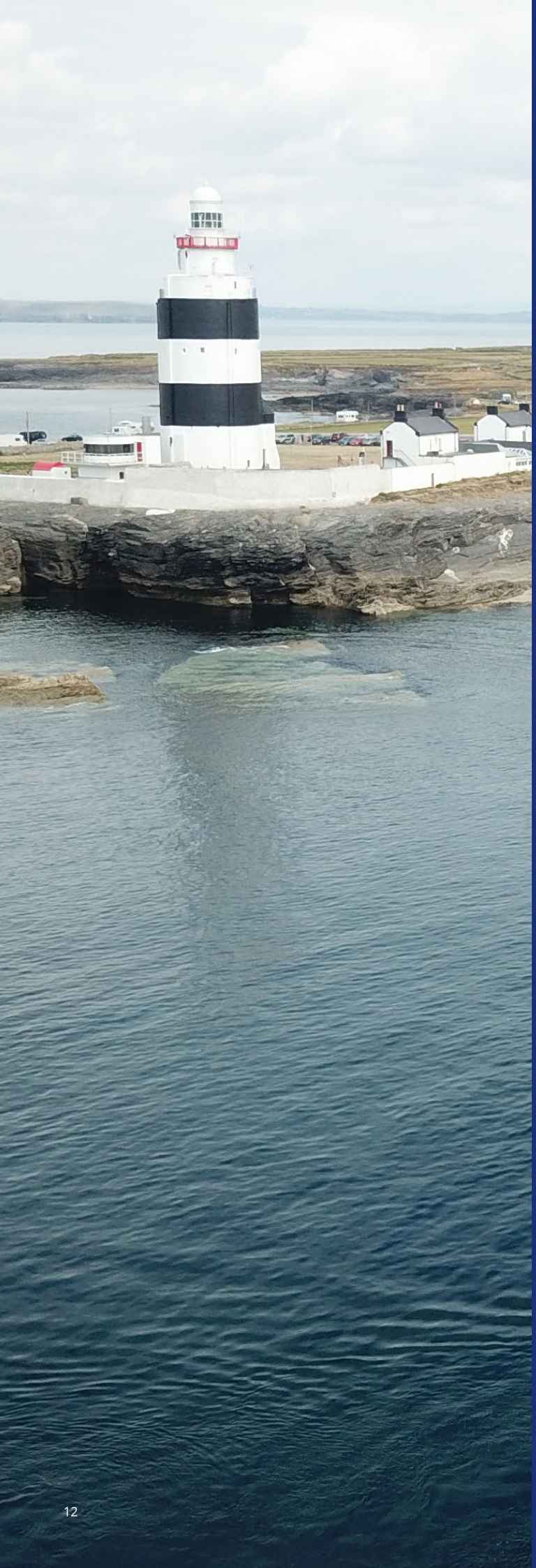
The programme has made contributions to the delivery of data, advice, and service support across various government strategic, policy, monitoring, and reporting areas, necessitating ongoing future state input beyond the end of 2026 (Section 3).

The review has identified several notable risks and challenges (see Section 4) to ultimately achieving the primary objective to the end of 2026, as well as a necessity to broaden the definition of success for INFOMAR given a number of critical spill over impacts and activities that have manifest over the programme life.



Stakeholders and management have noticed a deceleration in the processing and distribution of data, with a current lead time post-acquisition of about 1-2 years for the creation of final products. This issue has been compounded by the growing involvement of stakeholders with INFOMAR's resources, products, and survey support services, a trend driven by the rising interest in marine-based activities. For instance, INFOMAR's expanded services included supporting Offshore Renewable Energy development, guiding academic research such as PhD and Post-Doc studies, contributing to and leading projects funded through international initiatives such as the European Maritime, Fisheries and Aquaculture Fund (EMFAF) that extends to 2028 and the European Marine Observation and Data Network (EMODnet) that ends in 2027. INFOMAR also participated in Irish industry events like the Irish Skipper Expo, while also routinely supporting Irish Marine industry representation and networking at international trade shows, including Oceanology International. Collaborations were formed with various organisations, including The Hydrographic Society UK and Ireland, and the Marine and Renewable Energy Ireland (MaREI) Centre for Offshore Renewable Energy (ORE) projects. INFOMAR routinely provided multi-sectoral marine data engaging directly with regional stakeholders to optimise data impact. In the Shannon Estuary for example, the team collaborated with NPWS on pre-survey acoustic impact studies to alleviate concerns relating to the possible survey impact on the resident Bottlenose Dolphin population, protected under the EU Habitats Directive. Survey proceeded successfully and data were acquired and made public, before uptake by Shannon Foynes Port Company, ESB, NPWS, National Monuments Service and others, to inform and de-risk local and regional development plans.

INFOMAR also engaged in significant media activities and in educational outreach, both through events like the BT Young Scientist & Technology Exhibition, the Galway Science and Technology Festival, Science Blast, and coordinating and contributing to webinars, whether locally for the ORE application of INFOMAR data, or to the global audience through international community engagement on the General Bathymetric Chart of the Oceans (GEBCO). National heritage interest and science documentaries feature multiple aspects of INFOMAR achievements, including the "Great Lighthouses of Ireland" and "10 Things to Know About", while INFOMAR also features in the Ocean Exploration exhibition of the Belfast Titanic centre, and various Aquaria, museum and marine environment exhibits throughout Ireland.

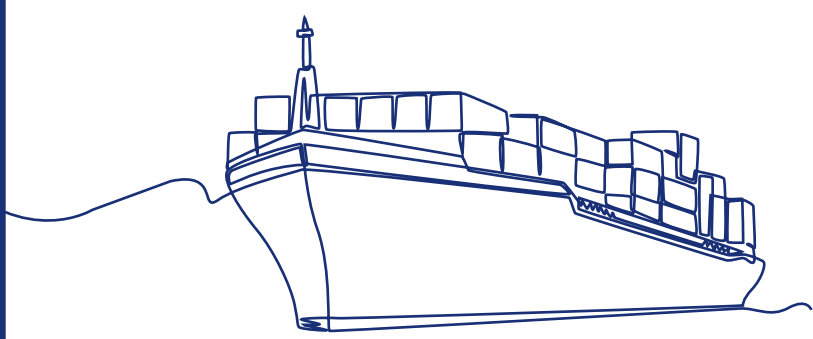


4. Critical spill over impacts

The INFOMAR programme has, and continues to have, several important spill over impacts, some of which are now critical to Ireland's legal, social, and economic standing in the context of marine sustainable development and protection measures. These critical spill over impacts are considered in this section, and in summary are broken down as:

01. Legal compliance and international standing
02. Sustainable economic development and impact
03. Environmental protection and heritage
04. Technology, innovation, and research
05. INFOMAR's contribution to Climate Change Research

These will each be explored in turn.



4.1 Legal compliance and international standing

The INFOMAR programme is both influenced by but is also essential to Ireland's compliance with several International, European, and National policies, regulations, and legislations. The legislative and regulatory requirements outlined in Appendix V that set out rules to ensure safety, uphold high standards for data collection, conduct thorough environmental assessments, and engage stakeholders effectively. INFOMAR has played a key role in helping the state fulfil its obligations in maritime safety, biodiversity and environmental monitoring, and marine spatial planning.

INFOMAR's role in supporting Ireland to comply with and adhere to various legislative, regulatory and policy requirements is a critical spill over impact, that in some instances could be considered as important, if not more important than the primary objective of the programme. These are captured below:

International

Policy/regulation/ legislation	INFOMAR Impact
United Nations (UN) Convention on the Law of the Sea (UNCLOS)	UNCLOS establishes a legal framework for all activities in the oceans and seas, including the rights and responsibilities of states regarding the use of marine resources and the protection of the marine environment. Under UNCLOS, Ireland has rights and obligations within its Exclusive Economic Zone (EEZ) and continental shelf, where much of INFOMAR mapping activities take place. The data generated by INFOMAR is essential for defining the boundaries of Ireland's EEZ and continental shelf, which in turn informs the management of marine resources within these areas.
Safety of Life At Sea Convention (SOLAS)	Ireland is a signatory to SOLAS (the International Convention for the Safety of Life at Sea) and therefore has an obligation under Chapter 5 to maintain up to date hydrography for the safety of navigation.
Convention on Biological Diversity (CBD), particularly the Aichi Biodiversity Targets[2] and the more recent Post-2020 Global Biodiversity Framework[3]	The CBD calls for the conservation and sustainable use of biological diversity, including the protection of marine and coastal ecosystems (United Nations, 1992). INFOMAR work in mapping and monitoring marine habitats directly supports Ireland's commitments under the CBD, contributing to the identification of areas that require protection and the development of strategies to mitigate the impacts of human activities on marine biodiversity. INFOMAR's delivery of the EMFF SeaRover Project and the associated Synthesis of outputs directly resulted in a significant increase in the spatial extent of protected areas in Irelands Marine territory.

[2] 'Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets' (2014). Montreal: Secretariat of the Convention on Biological Diversity.
[3] 'POST-2020 GLOBAL BIODIVERSITY FRAMEWORK' (2022). Montreal: Convention on Biological Diversity.

Policy/regulation/ legislation	INFOMAR Impact
International Maritime Organisation (IMO), through its various conventions such as the International Convention for the Prevention of Pollution from Ships (MARPOL)[4], the Ballast Water Management Convention[5] and IHO Special Publications (inc. S-44, S-57 & S-100).	Both the IMO & IHO are UN bodies primarily concerned with maritime safety & standards. These conventions and protocols also set standards for the prevention of marine pollution and the management of invasive species (International Maritime Organization, 1978), issues that are relevant to INFOMAR activities in areas such as port surveys and environmental monitoring (International Maritime Organization, 2004). INFOMAR data helps to identify pollution hotspots and assess the effectiveness of measures implemented under these conventions, and it's coordinated research directly assesses the potential future impact of wreck munitions related marine pollution.
United Nations Sustainable Development Goals[6] (SDGs)	Particularly SDG 14, which focuses on the conservation and sustainable use of oceans, seas, and marine resources. INFOMAR contributes to these global efforts by generating marine data that informs sustainable management practices, supports conservation efforts, and aids in the development of Marine Spatial Planning. The programme's integration of environmental, economic, and social data ensures that marine development is carried out in a manner that supports long-term sustainability and minimises adverse impacts on both the environment and local communities.

European

Policy/regulation/ legislation	INFOMAR Impact
EU Marine Strategy Framework Directive[7] (MSFD)	Aims to achieve Good Environmental Status (GES) of the EU's marine waters by promoting the sustainable use of marine resources and protecting marine biodiversity (European Commission, 2008). The MSFD sets out a framework for member states to assess the environmental status of their marine waters, establish targets and indicators, and implement measures to achieve GES. INFOMAR plays a role in helping Ireland meet its obligations under the MSFD by providing the necessary monitoring data to assess the health of marine ecosystems, monitor environmental changes, and support the implementation of protective measures. The directive also requires member states to develop and implement marine spatial plans, which must consider the ecological, economic, and social dimensions of marine resource management. INFOMAR mapping and data collection efforts are integral to the development of these plans, ensuring that they are based on accurate and up-to-date information. INFOMARs contribution to EU instruments such as EMODnet facilitates the delivery of outputs that deliver directly to EU Policy (EUSeaMap)

[4] International Convention for the Prevention of Pollution from Ships (MARPOL) (no date) International Maritime Organization. Available at: https://www.imo.org/en/about/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx (Accessed: 24 August 2024).
[5] International Convention for the Control and management of ships' ballast water and sediments (BWM) (no date) International Maritime Organization. Available at: https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-%28BWM%29.aspx (Accessed: 22 August 2024).
[6] United Nations, Department of Economic and Social Affairs, Social Development Goals (2015). Available at: https://sdgs.un.org/goals (Accessed: 11 September 2024).
[7] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (Text with EEA relevance) available at Directive - 2008/56 - EN - EUR-Lex (europa.eu)

Policy/regulation/ legislation	INFOMAR Impact
Habitats Directive[8] (92/43/EEC)	Seeks to conserve natural habitats and species of wild fauna and flora of European interest. The directive requires the designation of Special Areas of Conservation (SACs) within marine and coastal environments (European Community, 1992). INFOMAR work supports the implementation of the Habitats Directive by identifying and mapping habitats that are critical for the conservation of biodiversity, thus aiding in the designation and management of SACs, and their connectivity to future Marine Protected Areas.
Water Framework Directive (WFD) (2000/60/EC)[9]	Plays a significant role in the legislative environment of INFOMAR, as it establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater. The directive's goal is to achieve good ecological and chemical status of all waters by implementing integrated water resource management based on river basin districts (European Parliament & Council, 2000). INFOMAR contributes to the coastal and marine components of this directive by providing detailed seabed mapping data, seabed classification maps and sediment composition data, as well as associated metadata collation, supporting Ireland's efforts to meet the directive's objectives.

National

Policy/regulation/ legislation	INFOMAR Impact
Marine Planning and Development Management (MPDM) Bill	INFOMAR's role in providing accurate and detailed marine data will be crucial in informing the new planning processes introduced by the MPDM, particularly in relation to the identification of suitable sites for marine development, such as Offshore Renewable Energy (ORE) projects, and the designation of Marine Protected Areas (MPAs)
National Marine Planning Framework (NMPF)	INFOMAR data underpins much of the decision-making within this framework, aiding in the development of policies that align with national goals for economic growth, environmental protection, and social well-being.

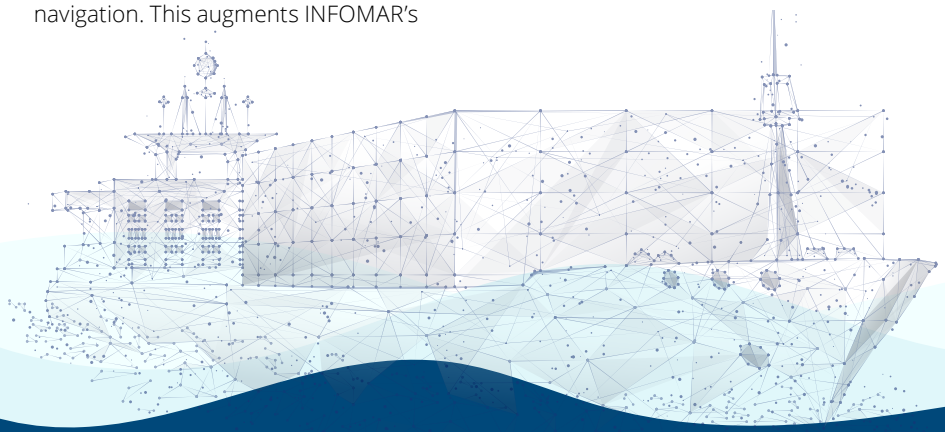
In addition to the compliance requirements, INFOMAR plays a key role in Ireland's international standing as a marine specialist nation. Globally INFOMAR programme partners are part of a network of marine scientists, policymakers, and organisations. As part of the international marine research community, INFOMAR is seen to be an exemplary leader and contributor to the advances in marine science and technology. For example, in 2022 representatives from the INFOMAR programme attended twenty-three conferences to present the programme and the work it is doing in the marine ecosystem. Throughout this review, all stakeholders expressed their appreciation of the INFOMAR programme and see it as global leader in their contribution to the advancement of our knowledge about marine ecosystems. The global reach of INFOMAR is further evidenced by INFOMAR being used as a case study to the 2023 launched "Partnership for

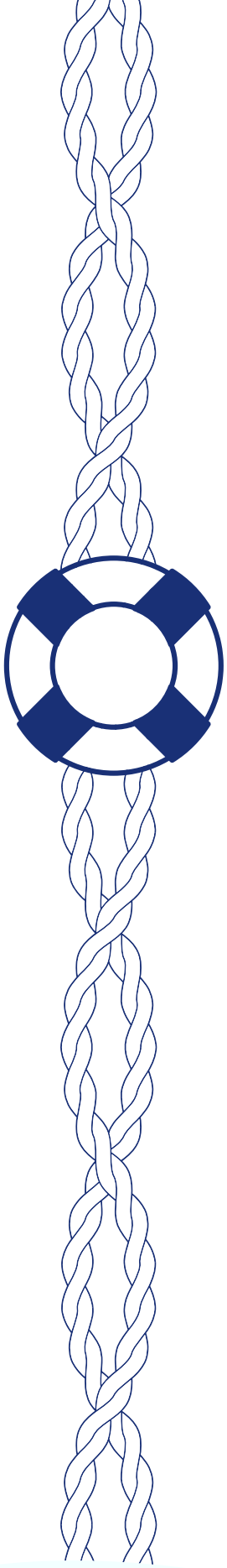
[8] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora Directive - 92/43 - EN - Habitats Directive - EUR-Lex (europa.eu)
[9] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy Directive - 2000/60 - EN - Water Framework Directive - EUR-Lex (europa.eu)

Atlantic Cooperation". An INFOMAR joint programme manager presented the INFOMAR programme as one of five Atlantic case studies on innovation and collaboration to the White House hosted Senior Officials meeting, held for the 40 countries now signed up to the partnership. Furthermore, INFOMAR co-chaired an Atlantic Seabed Mapping International Working Group that was setup under the H2020 Atlantic Ocean Research Alliance and succeeded in getting 1 million square kilometres of Atlantic Seabed mapped and contributed to the global Seabed 2030 campaign. An INFOMAR Team Lead currently participates in the International Council for Exploration of the Sea (ICES) at the Scientific Committee (SCICOM) level, as Irelands National Member, developing the ICES scientific plan for the next 5 years, and at the Working Group level. This global engagement is crucial for the continuous improvement of INFOMAR methodologies and practices, ensuring that the programme remains at the forefront of marine resource management.

In conjunction with the Marine Safety Office in Dept of Transport, INFOMAR attends all IHO Commission meetings such as the North Sea Hydrographic Commission (NSHC), S44 Standards Working Group (WG) and other WGs, where Ireland is a leader in the development of global strategies for future charting and delivery of hydrographic data. This has led to very good relations with the UK Hydrographic Office which incorporates INFOMAR data into nautical charting for the safety of navigation. This augments INFOMAR's data dissemination efforts to the global maritime community, both directly through web mapping services, and indirectly via EMODnet, NOAA NCEI, and Seabed2030 . The IMO audit on the "III Code" was also carried out in 2024 and INFOMAR was recognised as a major contributor to Ireland passing the audit with good standing.

Involvement and management in development of the outputs from EMODnet, has required INFOMAR engagement with Regional Seas Conventions (RSC) in order to establish their requirements for delivery of assessments (MSFD). Another significant aspect of INFOMAR's international collaboration is its involvement in the Seabed 2030 project. INFOMAR's high-resolution bathymetric data and detailed seabed maps have been instrumental in filling critical gaps in global ocean mapping efforts. By sharing its data openly and actively participating in the Seabed 2030 initiative, INFOMAR not only contributes to this global effort but also benefits from the collaboration and exchange of best practices with other leading marine mapping programmes. Similarly, INFOMAR's involvement in the European Marine Observation and Data Network allows it to share its data with a wide audience of researchers and policymakers, furthering the collective knowledge of Europe's marine environment, informing sustainable marine management practices, and consolidating Ireland's international standing in marine affairs.





4.2 Sustainable economic development and impact

INFOMAR's seabed mapping and marine data collection directly contribute to the expansion and development of various sectors within the blue economy, such as offshore renewable energy, fisheries, aquaculture, marine tourism, and maritime transport (Government of Ireland, 2016). The blue economy refers to the sustainable use of ocean resources for economic growth, improved livelihoods, and job creation, while ensuring the health of marine and coastal ecosystems.

Companies seeking to invest in the blue economy are more likely to invest in regions where they have access to reliable data that can inform their operations, reduce uncertainty, and lower the barriers to entry into a market. It was noted by a variety of stakeholders engaged for this review, that INFOMAR data is invaluable for planning and executing projects, mitigating risks, and optimising operations.

Currently, INFOMAR data is being used to underpin the planning, design, and construction of critical port infrastructure, electricity, and broadband subsea cables, and offshore wind developments. By providing precise bathymetric data and insights into seabed conditions, INFOMAR supports the planning and development of these projects, helping to attract investment and create jobs in the sector.

This places INFOMAR data and the programme team's technical and domain knowledge as a foundational element to the Governments Renewable Energy Strategy through the Climate Action Plan, but also its Digital Economy Strategy.

INFOMAR supports sustainable development by facilitating responsible fisheries management. The programme's data on seabed habitats and oceanographic conditions is used by the Department of Agriculture, Food, and the Marine (DAFM) to inform the management of fish stocks, designation of fishing areas and quotas under the EU Common Fisheries Policy[10].

By making its data freely available, INFOMAR ensures that a wide range of stakeholders, including government agencies, researchers, environmental organisations, and the public, can access the information needed to engage in sustainable economic and environmental practices. This open-access policy not only democratises the use of marine data but also fosters collaboration, inclusion, and innovation, enabling social cohesion and sustainable development informed by the best available scientific data. INFOMAR serves as a strategic employer, driving economic development, job creation, and overall strategic initiatives within the maritime ecosystem including coastal and rural areas across Ireland.

[10] Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC available at Regulation - 1380/2013 - EN - EUR-Lex (europa.eu)

4.3 Environmental protection and heritage

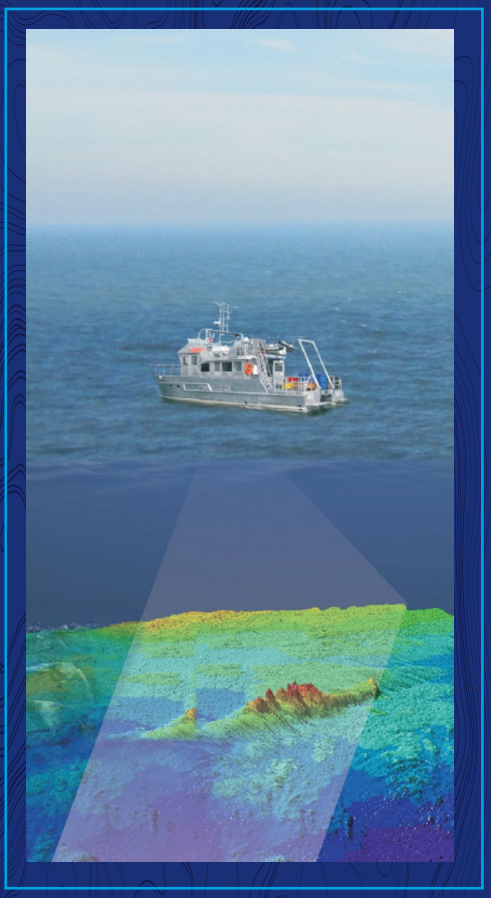
Groups such as An Taisce, the Irish Wildlife Trust, and BirdWatch Ireland are involved in advocating for the protection of marine ecosystems and biodiversity and are key stakeholders of INFOMAR. These organisations use INFOMAR's data to support their conservation efforts, monitor environmental changes, and ensure that marine habitats are preserved (Marine Institute, 2024). INFOMAR's detailed seabed mapping and environmental data contribute to the identification and protection of Marine Protection Areas and sensitive habitats.

One of the primary ways in which INFOMAR contributes to sustainable development and environmental protection, is by supporting Marine Spatial Planning. This critical process involves allocating marine space for different uses while ensuring that these activities do not compromise the health of the marine environment. INFOMAR's high-resolution bathymetric maps, habitat data, and geological surveys provide the essential information needed to create accurate and effective marine spatial plans (Flannery, et al., 2010).

INFOMAR datasets provide a baseline for assessing the ongoing environmental impacts of seabed infrastructure (e.g., subsea cables) and facilitates adaptive management practices. This is particularly important in a rapidly changing marine environment, where ongoing research and monitoring are crucial for minimising ecological disruption and ensuring the resilience of marine ecosystems.

INFOMAR's seabed mapping contributes to the preservation of Ireland's environmental heritage. By collaborating with entities like the National Monuments Underwater Archaeology Unit (UAU) and the CHERISH Project, INFOMAR plays a crucial role in identifying and safeguarding vulnerable underwater cultural sites, including shipwrecks and submerged landscapes.

INFOMAR's data also plays a crucial role in protecting and conserving marine biodiversity, which is a cornerstone of sustainable development. The programme's detailed mapping of seabed habitats allows for the identification of ecologically sensitive areas that require protection, such as coral reefs, seagrass beds, and spawning and nursing grounds for fish. By providing this information, INFOMAR supports the designation and management of Special Areas of Conservation under the EU Habitats Directive[11], which are essential for conserving biodiversity and maintaining the health of marine ecosystems. For instance, INFOMAR coordinated offshore reef habitat data acquired through the EMFF funded SeaRover programme (2017-2019), led to large scale protection of Irish Vulnerable Marine Ecosystems in 2022. These areas were closed through the Deep-Sea Access Regulation to remove the impact of bottom trawling, thereby protecting the structural integrity and biodiversity of the seabed. Two related new offshore special areas of conservation were subsequently designated extending the protection of the sensitive habitats mapped, and Ireland's progress to achieving marine protected area targets[12].



[11] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora available at Directive - 92/43 - EN - Habitats Directive - EUR-Lex (europa.eu)

[12] Ireland announces major boost in marine environmental protection to coincide with COP15 available at gov.ie - Ireland announces major boost in marine environmental protection to coincide with COP15 (www.gov.ie)

4.4 Technology, innovation, and research

INFOMAR leverages and perfects the use case of various cutting-edge technologies to map Ireland's expansive and diverse marine territories, which include the deep ocean, coastal zones, and everything in between. The programme has generated globally recognised expertise in the deployment and operations of multibeam echosounders and side scan sonars for systematic regional scale mapping, as well as Airborne LiDAR Bathymetry, and autonomous survey technologies. In addition to these innovative data collection techniques, INFOMAR has also developed specialist data management, analysis and visualisation skills, tools and services. The sheer volume of data generated by modern marine surveying technologies necessitates sophisticated systems for data processing, storage, analysis, and dissemination. INFOMAR employs GIS and specialist hydrographic and geophysical survey software to manage the vast datasets it collects, enabling the integration, visualisation, and analysis of spatial data from various sources. For example INFOMAR, in collaboration with the National Parks and Wildlife Service (NPWS) and supported by the European Maritime and Fisheries Fund (EMFF), conducted the SeaRover survey (2017-2019). using the ROV Holland I to map reef habitats along Ireland's continental margin. The goal was to establish a monitoring baseline for conservation and map vulnerable fisheries resources.[13]

Big data analytics and machine learning are increasingly being applied within INFOMAR to handle the growing complexity of marine datasets. These technologies allow for the automated processing of large volumes of data, identifying patterns, anomalies, and trends that might be missed by human analysts. For example, machine learning algorithms have been developed and implemented through INFOMAR coordinated research to map geomorphology (Arosio, et al., 2023) and to classify seabed habitats based on sonar data, or to detect changes in the marine environment over time (Xiong, et al., 2022).

INFOMAR's global reputation positions Ireland as a highly sought-after partner for marine geoscience, habitat mapping, and modelling projects. This is due to the country's access to free survey data and advanced marine survey infrastructure, further enhancing its leadership in advancing marine science and research. The programme's expertise in integrated marine mapping, supported by advanced survey technologies and data processing protocols, has led to the development of new methodologies and knowledge, enriching our understanding of the marine environment. Additionally, INFOMAR's partnerships with Irish and global universities on research projects, data utilisation, and scientific studies covering marine biology, geology, oceanography, fisheries, and environmental science enable access to international research funding, capacity building, and remote operational support. Such research is often directly linked to and/or informs policy, particularly when INFOMAR has engaged with the European and international community, as well as local organisations including AFBI, Loughs Agency, GSNI, and DAERA on cross border research, co-operation and capacity build initiatives.

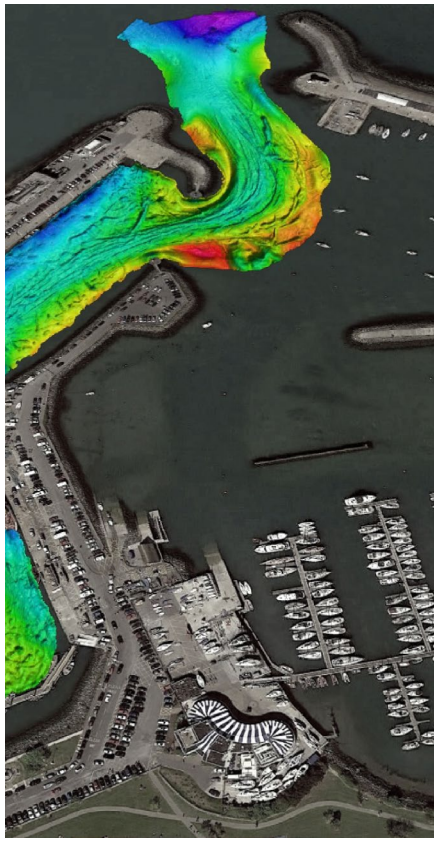
[13] Sensitive Ecosystem Assessment and ROBV Exploration of Reed (SeaRover) available at SeaRover (arcgis.com)

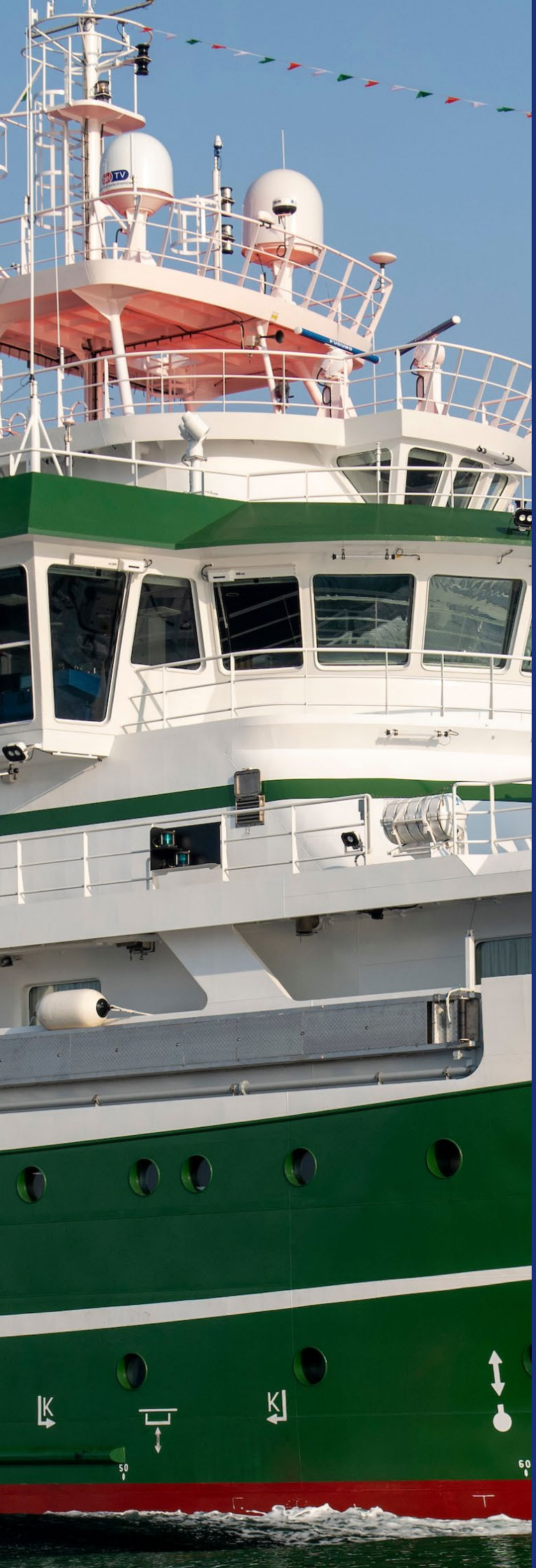
4.5 INFOMAR contribution to Climate Change Research

INFOMAR's role in climate change research and adaptation efforts is significant, primarily through its provision of geological and bathymetric data. This data provides crucial insights into coastal erosion, flood studies, sea-level rise, and sediment transport, all of which are worsened by climate change. By utilising this knowledge, INFOMAR contributes to the development of more effective coastal defence strategies, including the restoration of natural eco-barriers like dunes and wetlands, which can help mitigate the impacts of storms and rising sea levels. Additionally, the data supports the identification of carbon sinks, such as seagrass beds and cold-water corals, which play a vital role in capturing carbon dioxide from the atmosphere and mitigating climate change.

Furthermore, INFOMAR aids in biodiversity monitoring, allowing researchers to track shifts in species distribution and abundance related to climate change, while also examining ecosystem services and promoting sustainable management practices in Ireland's waters. Additionally, INFOMAR's data plays a crucial role in identifying shipwrecks, assisting the Irish government in pinpointing potential oil pollution and other environmental hazards, while also promoting cultural heritage preservation, angling, and marine underwater tourism. Leveraging this data allows authorities to proactively address the risks posed by sunken vessels, contributing to the protection of Ireland's marine environment and coastal areas.

In addition, INFOMAR is a participant in Mission Atlantic, a European initiative dedicated to the preservation of the Atlantic Ocean. The project aims to enhance understanding of marine life, promote sustainable fishing practices, and establish regulations for ocean conservation. INFOMAR contributes its expertise in marine mapping and data collection to study the Atlantic marine ecosystems, focusing on the impact of climate change and human activities on ocean habitats. This involvement allows for the assessment of environmental responses to various actions, aiding in the development of effective conservation strategies.





5. Risks and challenges

Taking consideration of INFOMAR's primary objective, critical spill over impacts, corporate governance (see Appendix 2) and the pillars of the programme , this review has assessed several risks and challenges for INFOMAR going forward spawning across its three pillars. Note that the opportunities for the future of INFOMAR are captured separately in the Foresight Assessment Report.

Risks

Challenges

Common (Org level)

Retention of talent - Retaining talent is a critical risk for the INFOMAR programme due to the specialised skills and expertise required. The staff are currently employed across a range of different contracts, including finite term contracts and full-time civil service contracts. There is a risk that employees on fixed term contracts may secure permanent positions in the private industry. If key personnel leave the programme, it can lead to significant disruptions in project continuity and loss of institutional knowledge, especially as the programme nears its final stage.

Succession planning - As INFOMAR approaches its final years, the absence of a robust succession planning strategy poses a significant risk. It is vital to capture and transfer the extensive knowledge and expertise of the current team, which has been instrumental in establishing Ireland as a global leader in seabed mapping. Ensuring that the insights and learnings from INFOMAR are effectively passed on to future generations is essential for sustaining this leadership and maintaining the program's legacy. Further, retention of the data and survey infrastructure knowledge and expertise is critical, to continue to deliver national capacity build, to underpin research and innovation, to state led data **requriements**

Continuous Data Refresh: Continuous data refresh requirements to meet legal obligations and facilitate marine area development and conservation goals.

Mandate alignment: Alignment of mandates and understanding among new government stakeholders for decision support and compliance needs.

Retention and training: Retaining and training necessary talent for data acquisition, particularly the unavailability of IHO Cat A accreditation in Ireland.

Resource constraints: Resource constraints related to the engagement of hydrographers and the need for larger datasets to meet diverse stakeholder needs.

Extended timelines: Extended timeline for product delivery due to data processing complexity, lack of data scientists and hydrographers, and reliance on external organisations.

Stakeholder feedback: Aspiration to improve inter-operability of hydrographic data and the lack of a formal feedback mechanism between INFOMAR and consumers for continuous improvement and refinement of disseminated outputs.

Pillar 1 - Data acquisition

Cost constraints in an escalating cost-input environment are anticipated to hamper data acquisition activities, risking the primary objective for the end of 2026.

The increasing trend of private providers mapping small, specific areas to incompatible data standards poses a critical risk of overlapping efforts, process inefficiencies, and potential threats to data sovereignty for Ireland. Moreover, the absence of a legal mechanism, mandate or formalised process for ,Government to seek, receive, integrate, and use a copy of all acquired data further complicates the situation. INFOMAR currently have capacity to provide key government support in this process, subject to knowledge and data expertise retention.

Skilled personnel are increasingly migrating from INFOMAR to other long-term projects or private providers, driven by the absence of a mandate and contract security beyond 2026. This poses a risk to the completion of the primary objective and jeopardises the delivery or implementation of a successor programme for future seabed mapping requirements.

During the assessment, it became evident from all stakeholders, including the INFOMAR leadership team, that data acquisition cannot cease at the end of 2026, even if the 100% coverage goal is achieved.

Certain areas and aspects of seabed and habitat mapping data will necessitate new data and ongoing refresh to meet Ireland's enduring legal obligations and to support marine area development and conservation goals.

This presents a significant challenge for the existing corporate governance arrangement. The retention of core GSI (DECC) staff beyond INFOMAR may offer some future maintenance capacity. However, MI INFOMAR staffing is anticipated to continue to decline in numbers due to the SLA dependent contracts which are due to expire end 2026.

Staff possess specialist technical competencies which are critical for ongoing support of existing major state investments in seabed mapping data and survey infrastructure. Moreover, SME contracted services dedicated to supporting inshore field programme activities face the risk of dissolution prior to INFOMAR completion, without clear indication of a medium to long-term mandate, or clarity on forthcoming continued service requirements through to 2030/2040.

An expanding number of government stakeholders are in need of new marine survey data to support decision-making and compliance requirements. It is essential for mandates to be aligned to ensure a shared vision and facilitate further progress, particularly with regard to the Marine Area Regulatory Authority, An Bord Pleanála, and County Planning Authorities.

Retaining and training necessary talent for current and future required data acquisition activities is a key challenge. While Hydrographers are critical to the accuracy, reliability and sign-off on marine surveys, no third level hydrography course is available in Ireland, and formal hydrographic training requires course attendance abroad, with limited organisations offering the highest IHO CAT A level hydrographic surveyor accreditation.

Risks

Challenges

Access to benthic habitat mapping training expertise for state acquired baseline habitat mapping, while less constrained, is still challenging due to the commercial career opportunities in supporting industry workloads to address permitting and EIA obligations.

Consequently, INFOMAR is delivered with hydrographic and habitat mapping management oversight, through significant informal in-house cross-training of staff and contractors, with a variety of typically scientific non-hydrographic or benthic habitat specific backgrounds. The recent introduction by the International Hydrographic Organisation (IHO) of the International Federation of Hydrographic Societies (IFHS) coordinated Hydrographic Professional Accreditation Scheme (HPAS), provides a means to recognise and formalise hydrographic upskilling. Through this scheme, one can over time with adequate effort and technical upskilling achieve HPAS level 1 accreditation, equivalent to graduating from an IHO CAT A accredited university course.

Data produced by INFOMAR is not immediately used for Safety of Navigation as the data is passed on to the United Kingdom Hydrographic Office to compile navigation products such as Navigation Charts and associated publications for mariners globally. IHO CAT A Cartographic qualifications for this are not currently available in Ireland and therefore if Ireland is to produce the new S100 format navigation charts an investment in this ability will have to be considered as these products require accredited sign off.

During our stakeholder interviews and a review of the organisation skill matrix of the programme, it was evident that while there are employees within the INFOMAR programme who have undertaken formal hydrographic training, due to the personnel resourcing levels and management structure of the programme, they are not dedicated solely to hydrographic tasks, and are required to undertake multiple functions including data management, programme coordination, reporting & administration.

Future continued effort to strengthen hydrographic and benthic habitat mapping expertise within the programme team and Irish 3rd level sector should be considered, in addition to wider future anticipated seabed mapping related skills requirements e.g. marine geotechnical engineering.

Pillar 2 - Data processing

It is acknowledged that data subset processing are routinely prioritised by INFOMAR where strategically important to government policy (e.g. ports / ORE development).

However, data integration lead times for regional product development, may risk key stakeholders seeking alternative data provision that may be of inferior quality, or lead to inefficiency and re-work.

Stakeholders have noted that some aspects of INFOMAR's data processing times are now considered lengthy relative to peer organisations and that the backlog of data to be processed and integrated post-acquisition is increasing leading to regional product delivery delays.

Stakeholders mentioned that this makes it particularly hard for them to plan their own organisational schedules as there is little insight available as to when processed data will become available for dissemination and publication.

INFOMAR management have noted that they have to work to single pass integrated regional product delivery, to minimise repetition of processing effort.

Timelines involved, relate to multi-annual acquisition in advance of regional data integration and product delivery, augmented by the processing challenges, particularly nearshore, where multi-vessel survey data are extensive in volume, more complex due to geological and depth variability (i.e. noisy), and require inter-vessel data levelling issues to be resolved.

Further, processing and data integration work is undertaken with finite personnel resources typically performing multiple role and duties.

Larger and larger datasets are created by more sophisticated mapping and surveying technology which require more resources to be able to process the data sets. Furthermore, adding to this there is greater demand for diverse datasets to meet the needs of a wider stakeholder cohort, and for wider use cases than the original INFOMAR programme scoping envisaged.

Risks

Challenges

In 2018, a decision was taken to include 2026 as a survey operations year in setting annual survey coverage targets (KPIs), removing a post survey window to complete products creation. Lead time from acquisition to product delivery is further challenging due the complexity of the data processing, the high standards of accuracy, the shortage of data scientists and hydrographers to process the data, the reliance on the UKHO for hydrographic data accreditation, and the diversity of new data products that INFOMAR developed, maintains, and reports on (e.g. MSFD).

INFOMAR aspires to emulate the IHO-developed S-100 Universal Hydrographic Data Model which works to provide guidelines to improve the inter-operability of hydrographic data between different organisations and institutes (International Hydrographic Organization, 2021), which would decrease the time taken for data processing and would improve accessibility of a wider variety of hydrographic data.

Pillar 3 - Dissemination and Value Added Services

Some stakeholders have mentioned difficulty in working with disseminated data but mentioned that INFOMAR personnel have been available for support on request, a resource that is increasingly strained by staff retention challenges due to the project nearing completion, contract terminations impending, and lack of succession planning. There is a key risk and concern that the highly valued multi-decadal INFOMAR data resource may not be leverageable to its full capacity in the future without a dedicated and focused data dissemination and knowledge transition/succession plan beyond completion of data acquisition, and more importantly without the necessary associated data skills retention.

INFOMAR should conduct a stakeholder data skills gap analysis to understand the challenges in use of data disseminated. Subsequently, data analysis skills workshops could be organised to address these issues, covering essential topics such as basic analysis techniques, data visualisation, statistics, data cleaning, data mining, machine learning, and working with diverse data types as the programme nears its final stage.

A risk to INFOMAR the brand as the project approaches 2026 is the potential loss of momentum and visibility, which could diminish its global recognition. Without a clear long-term strategy for data dissemination, stakeholder engagement, and resource continuity, there is a risk that the project's legacy and influence may not be fully realised, reducing its impact in the scientific and other communities.

Despite having developed some of the most advanced web mapping and digital data dissemination services globally, due to the open data policy, there is no formal feedback mechanism between INFOMAR and consumers on the disseminated data. This is a challenge for INFOMAR as there is no stakeholder feedback to help continually improve and refine disseminated outputs.

Understanding how existing consumers utilise data and its applications is limited. Similarly, the barriers encountered by potential consumers are not well understood, posing a challenge for INFOMAR to maximise its impact across various marine economic sub-sectors. Without a strategic, well-resourced customer-focused outreach, training, and customer engagement programme, addressing these challenges becomes even more difficult.

6. Review assessment and other observations

Since its inception, the individuals involved in the INFOMAR programme have been passionate and astute, recognising the significance of the project as an instrumental part of Ireland's future blue economy, and enabling INFOMAR to become a source of public sector innovation and scientific expertise. It has made a positive contribution to the achievement of public policy objectives and the wider blue economy and has supported broader international goals for ocean governance, sustainability, and environmental protection. It has helped Ireland in its compliance with its legal obligations and is relied upon by several nascent marine economic sub-sectors. It has built a reputation and brand for scientific excellence and has contributed to Ireland's reputation as a global marine research leader while significantly enhancing our understanding of our marine resources.

The programme's marine datasets have a positive impact on a wide array of stakeholders, underscoring the critical importance of achieving its aim to have 100% seabed mapping coverage by the end 2026. During this assessment all stakeholders of the programme recognise the importance of completing the KPI by 2026. While excelling in integrated marine mapping and the adoption of cutting-edge technologies, INFOMAR faces challenges in data transformation, budget, resource constraint and staff retention.

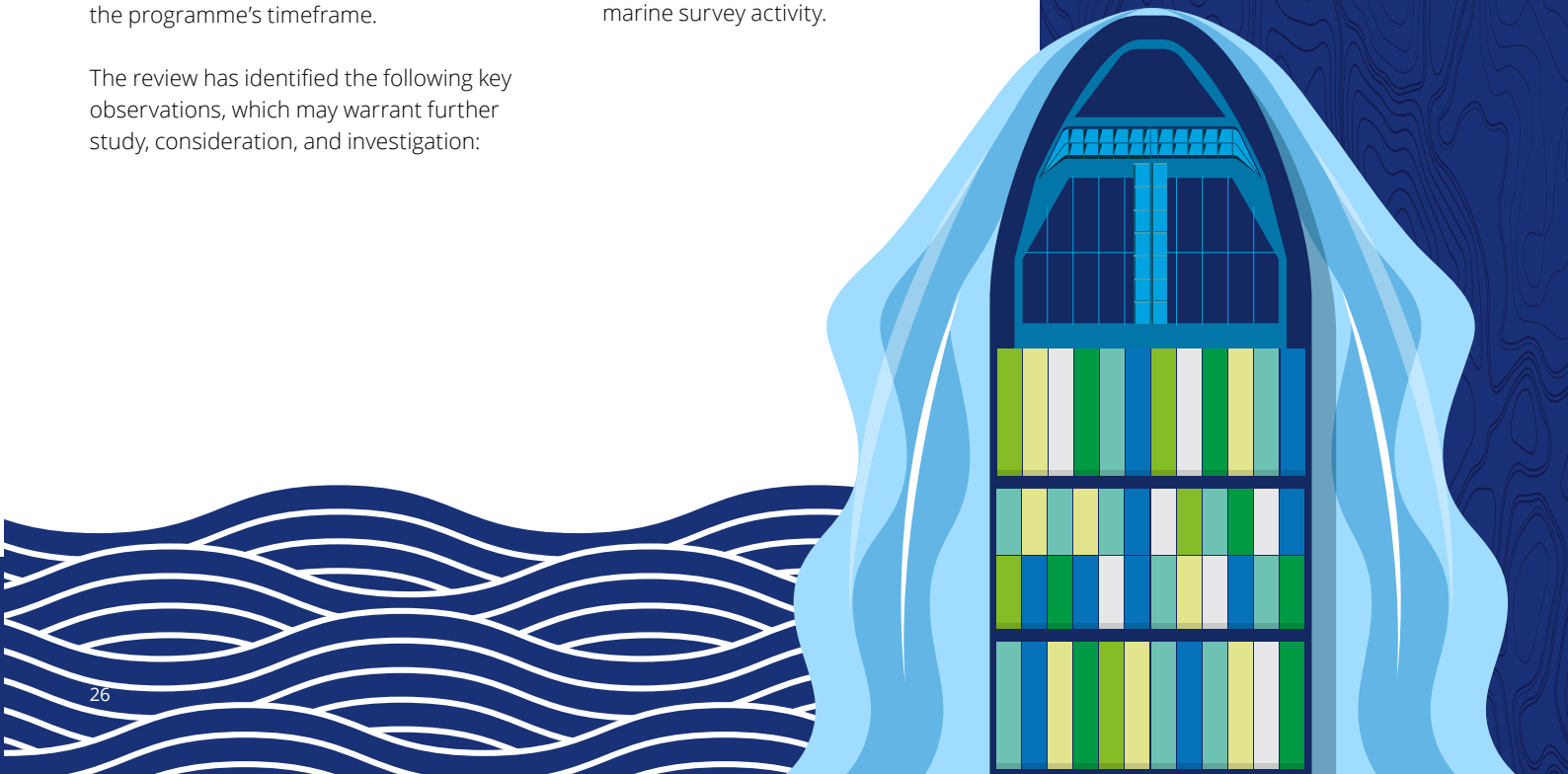
On review of INFOMAR's corporate governance there is a commitment to public access and transparency, demonstrated through the publication of progress reports and making its outputs open-source and available to the public free of change. It has adopted international standards and guidelines and regulatory frameworks demanded by the Irish public sector, and plays a leading role in European and international data collation and dissemination, through EMODnet, ICES, OSPAR, IHO, and Seabed 2030.

INFOMAR continues to pursue its primary objective, with stakeholder consultation highlighting the significant importance of the spill-over effects of its activities. These effects have become increasingly important to the programme, its partner organisations, and its stakeholders over the programme's timeframe.

The review has identified the following key observations, which may warrant further study, consideration, and investigation:

01. While the programme mandate currently runs to the end of 2026, it is noted from post COVID programme progress reporting that achieving the 100% survey coverage goal, and processing and disseminating the data, may run beyond this deadline. A "schedule and cost" assessment to complete the programme should be undertaken considering options to fast track by increasing annual survey and processing effort in 2025 & 2026, and/or extend through to completion at the current effort and resource allocation level. The programme mandate should be amended accordingly thereafter.

02. Building on observation 1), it is noted that the programme ought not to "finish" when the 100% goal is achieved. The critical spill over impacts and the necessity for refreshed and updated data will continue to persist – particularly as marine development also increases in the years ahead. Consideration needs to be given to a replacement programme, or to modifications to partner organisational mandates, or to a private sector contracting and contractor management approach, beyond the current programme duration. A study should be undertaken of the most optimal approach for this next phase of marine survey activity.



03. Building on observations 1) and 2), it is noted that the current corporate governance arrangements may not be suitable for further or enhanced mandates of INFOMAR. This warrants further study particularly if pursuing observation 2). If the INFOMAR programme adjusts its timeline, there are governance risks tied to its SLA. Challenges with stakeholder coordination, funding, resource allocation, data quality, compliance with regulatory standards, technological and operational risks, and political and public perception risks could also arise. Navigating these risks would require a governance structure that maintains strong oversight, transparent communication, and adaptability to uphold both the operational, data and value added objectives of the programme.

04. If the programme is allowed to end when its primary objective is achieved, there will be staff related consequences, namely the current SLA employed staff will be subject to increased pressure to move to the private sector during the coming two years. This raises a critical risk to the programme achieving its main goal as the deadline for completion approaches, and/or to INFOMAR transitioning to support any future related initiatives or government requirements (e.g. ORE/Compliance Support).

A. It is critical that consideration be given to the change requirements and any transition programmes being put in place. A strategic planning exercise that considers the personnel within INFOMAR should be carried out as soon as possible to limit the loss of expertise and knowledge and to provide clarity to the staff on the future.
B. The attrition of 1/3 of MI INFOMAR technical staff in recent months is explicitly related to individuals seeking enhanced longer term employment security elsewhere. Early consideration and/or acknowledgment of the government requirement for programme continuity, a formal extension, or a bridging/transition initiative is critical to ensure staff

are still in place in 2026 to work towards INFOMAR completion. This could involve implementation of an interim 2027-2030 mapping, monitoring & future requirements scoping initiative with Project Ireland Marine 2040 corporate governance oversight, to ensure key survey support services are incorporated, including for ORE, MPA, MSP, MSFD, MARA, ABP, and CPAs etc, in advance of implementation of a cross-government successor programme/ initiative/entity.

05. It is noted that the primary objective of INFOMAR does not account for the critical spill over impacts referenced in section 3 that the programme is responsible or partly responsible for. Consideration should be given to an expanded set of objectives and goals for the programme, that can be pursued and tracked going forward.

06. The Dissemination and Value Added pillar of INFOMAR should consider a review for potential partnership models. There may be opportunities for the Dissemination activities to transition from passive data provision to proactive data promotion. Further engagement with existing customers is needed to understand their needs and use cases, potentially enabling further funding opportunities.

07. The programme should consider undertaking an economic impact assessment, to better understand its role in the economic ecosystem, particularly with respect to its wide stakeholder reach and role in coastal and rural Ireland economies.

08. Explore options for additional personnel resourcing to reduce the current data processing backlog and lead times, and continue to investigate AI based data processing and analytics to maintain a state of the art approach to data management and dissemination.

09. Consider undertaking a formal corporate governance review.

10. Continue working with local universities and colleges to help address gaps in the marine education system and consider development of further modules for upskilling new government marine agency and marine local authority staffing, as well as for university delivery to students, to close this gap. Additionally, INFOMAR should look at external partnerships to upskill their existing staff in these areas.

11. As the INFOMAR programme progresses towards its 2026 completion deadline, it is crucial to carefully review staffing needs to ensure alignment with the core roles required to achieve the programme's objectives. This includes reviewing staffing arrangements and existing workloads, and if necessary, seeking additional funding for key roles to balance HR requirements.

7. Conclusions

INFOMAR stakeholders view the programme's infrastructure, knowledge, and outputs as a key driver for Ireland's future blue economy and a flagship example of public sector innovation and scientific excellence. INFOMAR continues to support public policy, fulfill state legal obligations, underpin the blue economy, and contribute to international goals related to ocean governance, sustainability, and environmental protection. The programme has established Ireland as a global leader in scientific research, innovation, sustainable marine governance, international collaboration, and open spatial data services.

There is strong consensus among stakeholders that the design and implementation of a continuation programme is crucial to meeting current and future state requirements and obligations. To mitigate risks to the completion of INFOMAR and its future commitments, the retention of knowledge and expertise is vital. This necessitates early consideration of the government's need for programme continuity, and the prompt initiation of a formal extension or bridging initiative to ensure key staff remain in place through 2026 to support the programme's completion. One potential solution could be the implementation of an INFOMAR Transition Programme from 2027-2030, which would focus on mapping, monitoring, and scoping future requirements, under the oversight of Project Ireland Marine 2040, in preparation for a cross-government successor programme beyond 2030.

Stakeholders continue to stress the importance of achieving 100% seabed mapping coverage by the end of 2026, in line with the programme's core KPI. However, they also recognise the programme's significant spillover impacts across several policy areas beyond its original objectives. These include sustainable fisheries, environmental protection, research and innovation, training and education, and contributions to the Government's Offshore Renewable Energy Development plan.

While no inflation was accounted for in INFOMAR's original cost estimates from 2006, the programme remained on track with its coverage targets until 2022. Due to recent global economic shifts, INFOMAR has slightly fallen behind in completing the bathymetric operational aspect of seabed mapping. As of the end of 2024, preliminary coverage estimates show that 81% of the target area has been mapped, with 6% per annum currently being achieved with the available resources, funding, and ship-time.

Appendix I – Acronyms

Acronym	Full Name
AI	Artificial Intelligence
ALB	Airborne LiDAR Bathymetry
CBD	Convention on Biological Diversity
C&AG	Comptroller and Auditor General
DAFM	Department of Agriculture, Food, and the Marine
DCU	Dublin City University
DECC	Department of the Environment, Climate and Communications
DHLGH	Department of Housing, Local Government and Heritage
DoT	Department of Transport
DPER	Department of Public Expenditure and Reform
EEZ	Exclusive Economic zone
EMODnet	European Marine Observation and Data Network
EPA	Environmental Protection Agency
EU	European Union
GDPR	General Data Protection Regulation
GES	Good Environmental Status
GIS	Geospatial Information Systems
GSI	Geological Survey Ireland
ICHEC	Irish Centre for High-End Computing
IHO	International Hydrographic Organisation
IMO	International Maritime Organisation
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
INSS	Irish National Seabed Survey
ISO	International Organisation for Standardisation
KPI	Key Performance Indicator
LIDAR	Light Detection and Ranging
LLP	Limited Liability Partnership
MARA	Maritime Area Regulatory Authority
MaRei	Centre for Marine and Renewable Energy
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder

Acronym	Full Name
MI	Marine Institute
MPA	Marine Protected Areas
MPDM	Marine Planning and Development Management
MSFD	Marine Strategy Framework Directive
MSP	Marine Spatial Planning
NDP	National Development Plan
NGOs	Non-Governmental Organisations
NOAA NCEI	US National Oceanic and Atmospheric Administration/National Centres for Environmental Information
NMPF	National Marine Planning Framework
NUIG	National University of Ireland, Galway
OPW	Office of Public Works
ORE	Offshore Renewable Energy
QMF	Quality Management Framework
ROVs	Remotely Operated Vehicles
R&I	Research and Innovation
RV	Research Vessel
SAC	Special Areas of Conservation
SDG	Sustainable Development Goal
SLA	Service Level Agreement
SOLAS	International Convention for the Safety of Life at Sea
TAC	Technical Advisory Committee
UCC	University College Cork
UCD	University College Dublin
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UN	United Nations
UNCLOS	UN Convention on the Law of the Sea
UNESCO	UN Educational, Scientific & Cultural Organisation
US	United States
VfM	Value for Money
WFD	Water Framework Directive

Appendix II – Corporate governance review

The corporate governance of INFOMAR is a critical aspect of its overall effectiveness and sustainability. This section encompasses a review of corporate governance structures entailing a review of INFOMAR's service level agreements, Board, Steering Committee, risk management framework, compliance framework, data management framework and financial management framework.

DECC Marine Institute INFOMAR Service Level Agreements

A Service Level Agreement is a core corporate governance document that sets out an entity's terms and conditions, funding arrangements and how that funding is to be used. It also lays down governance areas such as Public Procurement procedures, legal matters, and monitoring and any other specific conditions relevant to the organisation in question (Irish Government, 2020). As a result of the Department of Public Expenditure and Reform (DPER) Circular 13/2014, addressing the management and accountability for grants from Exchequer funds, DECC has implemented a structured Service Level Agreement (SLA) with Marine Institute (DECC and Marine Institute, 2016). This is to address the compliance issue of Grant-Aid funds transfer between DECC and Marine Institute (DAFM), which was not a requirement when the INFOMAR programme began. GSI are not subject to a Service Level Agreement as they remain within DECC.

(DECC and Marine Institute, 2016). The circular mandated frameworks for the administration of public funds, emphasising transparency, efficiency, and measurable outcomes in the utilisation of government resources (DPER Circular 13/2014, 2014). These agreements are designed to clearly define expectations, deliverables, and performance standards, and bind Marine Institute INFOMAR service provision to DECC to agreed-upon objectives and timelines.

The DECC Marine Institute INFOMAR SLA specifies the types of marine mapping services to be provided, the standards for data accuracy and quality, and the deadlines for data submission and reporting. This agreement also incorporates mechanisms for regular progress reviews and audits, ensuring that the Marine Institute INFOMAR related programme activities align with SLA specific strategic goals and compliance requirements.

INFOMAR Board

The Boards primary function is to provide strategic oversight and governance, ensuring that INFOMAR activities not only align with national and EU policies on marine and coastal management but also contribute to the

broader objectives of economic development, environmental protection, and scientific advancement. This involves a review and approval process for the programme 's annual work plans, where the Board assesses the relevance and feasibility of proposed mapping projects, research initiatives, and outreach activities. They ensure that these plans are effectively prioritised to meet Ireland's most pressing marine challenges, such as climate change adaptation, biodiversity conservation, and sustainable resource exploitation (INFOMAR, 2007).The Board of INFOMAR is responsible for steering the programme towards achieving its mission of advancing Ireland's marine knowledge and supporting sustainable marine resource management. This Board is composed of senior representatives from a variety of sectors including government agencies, the GSI and the MI (INFOMAR, 2020).

INFOMAR's governance structure is anchored by quarterly Board meetings. The meetings are used for reviewing progress, assessing work programmes, and making decisions. These meetings, typically held every three to four months, are attended by Board members, and other representatives including the joint programme managers to present and take part in the meetings. The meetings serve as a platform for discussing a range of issues, from reviewing previous meeting minutes and evaluating project budgets to conducting programme reviews and assessing achievements and outcomes (INFOMAR, 2020). Actions are regularly assigned to various members during these meetings to ensure the effective implementation of decisions made, and all meetings are documented by the INFOMAR administrator, with minutes circulated to the Programme Board to maintain transparency (INFOMAR, 2023).

The Board is responsible for continuously monitoring and assessing the performance of the programme, both internally and externally (INFOMAR, 2023). This includes regular evaluations of INFOMAR projects and initiatives against established goals and the KPIs. The Board also monitors associated risks, particularly overseeing the budget, expenditure, and maintaining the programme-specific Risk Register, which is distinct from the broader departmental Risk Register. Feedback from discussions with Board members and stakeholders in several workshops (refer to full list of stakeholders engaged in the Appendix) indicates a positive perception of the Board and its decision-making processes. Based on our discussion with individual Board members, the Board maintains a balanced tone and encourages constructive discussions, there have been instances where some members may hesitate to voice concerns or challenge prevailing views, suggesting a need for ongoing efforts to promote open dialogue. Despite this, stakeholders have acknowledged the Board's ability to identify areas of strength within the programme and areas requiring improvement, helping INFOMAR to remain adaptable and responsive to emerging trends and challenges in marine science and policy (INFOMAR, 2024).

Steering Committee

The INFOMAR Technical Advisory Committee (TAC) serves as a steering committee that provides technical guidance on the INFOMAR programme (INFOMAR, 2019). The committee, primarily consisting of senior engineers, hydrographers, marine biologists and geologists, is responsible for raising key issues relevant to INFOMAR programme planning and operations, maximising the impact of products and services, communicating programme data and results, capturing research and innovation opportunities, and enhancing the value of the INFOMAR through collaboration and ancillary data gathering (INFOMAR, 2020).

Risk Management Framework

INFOMAR operates within a risk management framework designed to identify, assess, and mitigate risks that could impact the successful delivery of its programme objectives. Given the complex nature of marine surveying, which involves navigating challenging environments, deploying advanced technologies, and managing

a wide range of stakeholder interests, the risk framework is a critical component of INFOMAR's operational strategy. This framework has been established to ensure that potential threats to the programme's success are managed and that contingency plans are in place to address unforeseen challenges.

This includes financial risk, strategy, and policies, programme resourcing, programme operations and product delivery, market risk, and other risks such as reputation and public awareness risks. Each identified risk is assessed based on its likelihood and potential impact, allowing the programme to prioritise its risk management efforts and allocate resources effectively (INFOMAR, 2010). Central to INFOMAR's risk management process is its Risk Register (INFOMAR, 2010), a document that captures all identified risks, along with their assessments, mitigation strategies, and monitoring protocols. To effectively assess INFOMAR's risk framework, this Risk Register was provided, outlining potential risks across those previously defined. This register is regularly reported to the Board and examined during Board meetings (INFOMAR, 2023). Currently only one 'red status' severe risk denoted on the risk register, that the Programme is unable to complete the data acquisition process covering 100% of the Irish seabed by the end of 2026. This risk is critical as it directly threatens the ability of the INFOMAR programme to achieve its primary objective of fully mapping Ireland's seabed by the end of 2026. To address this risk, INFOMAR plans to assess all remaining annual operational coverage to determine what is achievable within the existing budget.

Compliance Framework

INFOMAR has developed a compliance database to manage and document the various aspects of its operations and impact (INFOMAR, 2019). This register is managed and maintained by a single resource. The register is organised into categories covering a range of themes, from general areas such as planning, environmental, and public sector data, to more technical fields such as bathymetry, hydrography, and mineral resources. For each compliance element listed, INFOMAR outlines how they meet the associated obligations and identifies the responsible parties such as the DHLGH, DPER, Environmental Protection Agency (EPA), DECC, Natural Parks and Wildlife Services, Department of Justice and the DoT, Tourism and Sport. This database serves as a central repository that tracks compliance with relevant regulations and standards but also highlights the broad utilisation of INFOMAR's data across multiple domains. INFOMAR's data collection, processing, and dissemination practices comply with recognised national and international standards, such as ISO (International Organisation for Standardisation) 9001 for quality management systems and ISO 19115 for geographic information metadata. It includes detailed records of the standards adhered to, the procedures followed to ensure data accuracy and reliability, and the audits conducted to verify compliance.

Data Management Framework

INFOMAR relies significantly on the data quality management processes established by the GSI and the MI (Geological Survey Ireland, 2022). INFOMAR's framework for data management and quality assurance draws from standards and practices implemented by these organisations. The GSI and the MI's established procedures, which include comprehensive data validation, adherence to international quality standards, and metadata documentation, form the foundation of INFOMAR's approach to ensuring the accuracy and reliability of its marine data (Geological Survey Ireland, 2020). The Marine Institute hosts Ireland's National Oceanographic Data Centre (NODC), and obtained international accreditation of its Data Management Quality Management Framework (QMF) by the (UNESCO) International Oceanographic Commission's IODE programme in 2019. The IODE (International Oceanographic Data and Information Exchange) programme designates national oceanographic data centres and has a central coordinating role internationally. The main purpose of the IODE is to enhance marine research, exploitation and development, by facilitating the exchange of

oceanographic data and information between participating Member States, and by meeting the needs of users for data and information products. Advances in INFOMAR's approach to data management and science are outlined in section 2.5.4.

INFOMAR has developed a data management and quality assurance policy that is designed to ensure the accuracy, reliability, and integrity of the marine data it generates. This framework is structured around the established data management and quality assurance practices of the MI and is also aligned with the ISO 9001:2015 quality management system standards (Geological Survey Ireland, 2022). (Marine Institute, 2019).

The goal of this framework is to establish INFOMAR as an international centre of excellence in the provision of open access, high-quality data, and information services. From our discussions with the Board, it was revealed that the framework is currently being coordinated by a single individual within the programme, and while several staff contribute to data management QMF processes, this introduces a level of concentration risk. The reliance on one person for the development of such a critical component of INFOMAR's operations may result in potential gaps or delays in the implementation process. Similarly, insights gathered from stakeholder workshops have indicated a strong desire for training in data management. This training would not only enhance the overall data management capabilities within the programme but also help mitigate the current over-reliance on a single individual.

Financial Management Framework

INFOMAR's financial management framework includes policies and procedures for financial planning, expenditure control, monitoring, and reporting, all of which are aligned with national and international standards. The framework is continually reviewed and updated to reflect changes in financial regulations, best practices, and the evolving needs of the programme (INFOMAR, 2023). INFOMAR's financial performance will be discussed in more detail in section 4.6 below.

The funding model for INFOMAR places an emphasis on cost efficiency and delivering VFM. In line with public sector financial management guidelines, such as the DPER Circular 13/2014, INFOMAR is subject to financial oversight by the Board (DPER Circular 13/2014, 2014). This includes detailed budgeting processes, regular financial reporting, and comprehensive audits through the Comptroller and Auditor General (C&AG) to ensure that funds are being used appropriately and that expenditures are directly aligned with the programme's strategic objectives (DECC and Marine Institute, 2016). Another important aspect of INFOMAR funding model is its adaptability. The programme is designed to be responsive to changing conditions and emerging opportunities to adjust its focus and reallocate resources to ensure that it remains at the cutting edge of marine mapping and research (INFOMAR, 2007).

Safety

The INFOMAR programme adheres to safety standards that are in line with international maritime regulations. These protocols cover all aspects of the programme's operations, from the planning and execution of surveys to the maintenance and operation of vessels. Each survey mission is preceded by risk assessments, which identify potential hazards and outline mitigation strategies. Crew members and scientific staff undergo safety training, which includes emergency response drills, equipment handling, and familiarisation with the vessels' safety systems. This training is regularly updated to ensure that all personnel are prepared to deal with emergencies, such as man-overboard situations, equipment malfunctions, or severe weather conditions. The programme's vessels are equipped with safety systems, including lifeboats, life rafts, fire suppression systems, and advanced navigation aids that help avoid collisions and groundings.

From our discussions with the Board and its stakeholders, safety is the most crucial component of the INFOMAR programme. The Board, the programme and its stakeholders understand the dangers of ocean going activities and the safety of its resources is non-negotiable. The programme has no reported catastrophes or safety issues throughout its lifecycle. This is indicative of the effectiveness of its safety protocols and the professionalism of its crew and staff. The programme's vessels are regularly audited and inspected by maritime safety authorities to ensure compliance with national and international safety standards. Any incidents, however minor, are investigated, and lessons learned are integrated into updated safety procedures to prevent recurrence.

Human Resources

The successful delivery of the INFOMAR programme is heavily dependent on skilled scientific personnel. During our programme review, INFOMAR personnel expressed enthusiasm for the sector and pride in working for the INFOMAR programme. However, several INFOMAR personnel reported an over-utilisation of their role profile to meet the demands of the programme resulting in them working beyond their contracted hours. This overextension affects individual well-being and job satisfaction and raises the potential for burnout and the risk of attrition to the private sector. Staff attrition to the private sector has accelerated as the programme approaches its 2026 planned conclusion. With reduced job security and the absence of clear institutional succession planning in place, many former personnel from the Programme have resigned their posts, often with valuable irreplaceable scientific expertise .

Diversity in terms of gender and age is an issue in the marine sector with INFOMAR being no exception. The gender divide is a key issue in the maritime sector, according to the 2021 IMO-WISTA Women in Maritime Survey Report[14] women account for only 29% of the overall workforce in the general industry and 20% of the workforce of national maritime authorities in IMO Member State of which Ireland is a member. The GSI, MI and INFOMAR all recognise this gender divide and have been actively working together to close it.

Currently there is a gender and age imbalance within the programme;

The GSI has a **3:1** male-to-female ratio

47% of its staff being over the age of **39**

In contrast, of the MI's **49%** employees are female (but remains male-dominated at the leadership levels)

with an older employee profile where **25%** of staff are under 40 years of age.

As part of INFOMAR's succession planning, it is working towards incorporating DECC's 'Equality Diversity and Inclusion Strategy and Action Plan **2023 – 2025** recommendations into its operations.

Promisingly for INFOMAR's talent and future leadership pipeline, **80%** of participants in the most recent internship programme were female, tackling both the gender and age imbalances in the programme.

[14] Women in Maritime Survey 20210 available at Driving diversity in maritime through data (imo.org)

Appendix III – Resources and Qualifications

The table below summarises the key resources and their competencies utilised in the INFOMAR programme from both the MI and GSI. MI INFOMAR assigned staff are resourced through twelve sanctioned posts specified in the "Marine Institute DECC INFOMAR Service Level Agreement (SLA)". These positions include "specified purpose contracts" and "contracts of indefinite duration", with ten in Advanced Mapping Services (AMS) and two embedded in Information Services & Development (IS&D), both operating under the Ocean Climate & Information Services division of the Marine Institute.

Marine Institute Resources:

Position	Qualifications	Skills	Roles & Responsibilities
AMS Section Manager Joined MI - 18/03/2003	MSc Marine Geotechnics, BSc Earth Sciences	• Geophysics - Oil & Gas 3D Exploration Seismic Acquisition and Data Processing & ORE Ultra High Resolution Reconnaissance Geophysical Survey Coordination • Hydrography – INSS and INFOMAR Joint Programme Management, Financials, Research coordination • EU Project Work Package Coordination (H2020, EMFF, EMFAF) • Technical & scientific reporting and publications	• INFOMAR Programme Corporate Governance (SLA Compliance and Reporting, Programme Finances, Reporting, Board & Technical Advisory Committee meeting coordination • Programme Team Management • Leveraging Value Added Exploitation programme opportunities – Reconnaissance Geophysical Surveys for DECC ORE commitments – EMFF funding for SeaRover benthic habitat mapping leading to new SACs / Deep Sea Fisheries Regulation Closures
Hydrographic Survey - Team Lead Joined MI - 18/08/2003	PhD in quaternary marine processes MSc Marine Science	• Qualified Hydrographer (HPAS level 1) • Qualified Academic researcher (PhD) with competencies on grant application, scientific publication of high-level peer reviewed research on survey and marine related topics. • Project manager and research supervisor for Nationally funded initiatives (e.g. SBIR) and funded research projects (PhD's and post docs) • Two decades of hydrographic and geophysical survey experience in Government (INSS, INFOMAR) and commercial settings (Thales, Teledyne Reson). • Competent on many surveys related practices, software and methodologies. • Technical & scientific reporting and publications.	• Hydrographic Team Leader with key functions within the AMS-INFOMAR group. • Support the Management and development of hydrographic and geophysical infrastructure within the Marine Institute including tenders, equipment installations and quality acceptance. • Support and coordinate the INFOMAR hydrographic data flow, from instrument installation, calibration, survey planning, data acquisition, processing and delivery of data and services to end users. • Supervise and lead survey team • Develop and coordinate research activities within MI and AMS, promote novel ideas and supervise funded research. • Coordinate and steer various aspects of INFOMAR value added program, such as the development of the MSc Modules, data management WG • Represent INFOMAR at National and International conferences and events.

Position	Qualifications	Skills	Roles & Responsibilities
Geophysicist-STO Joined MI - 28/04/2003	MSc Applied Geophysics BSc Geology	• Hydrographic and geophysical survey experience in Government (INSS, INFOMAR) and commercial site surveys • Survey planning, design and coordinating • Technical and scientific reporting • Teaching hydrographic and geophysics survey methods.	• Chief Scientist on INFOMAR surveys • Geophysical data acquisition, processing and reporting • Lecturing and providing ship training and mentoring to MSc students • Supporting MI vessels surveys with technical knowledge on equipment setup and troubleshooting.
Geoscience Survey - Team Lead 18/09/2006	MSc Marine Geotechnics	• Geophysical and Geotechnical Survey experience in International Commercial 2D Exploration and Geohazard Seismic Acquisition, Data Processing, Oil & Gas and ORE Site Reconnaissance and Cable Routes. Team Leader and Reports Coordination. • Hydrography - INFOMAR Survey Team Lead • Value Added Programme Management, Procurement, Operational and Personnel coordination. • Project Management - Development, Co-Ordination and Delivery of EU Projects. Including EMODnet Seabed Habitats (Work Package Lead), Peace+ (Project Development). • Science and Policy Integration through participation in relevant fora (e.g. UN Decade Ireland Committe Member / EMODnet For The Ocean Decade Co-ordination Committe Member / GEOHAB). • Technical & scientific reporting and publications. • Competent on geophysical survey related practices, software and methodologies.	• Contribute to management of hydrographic and geophysical survey and sampling/imagery campaign planning. • Coordination of equipment, personnel, and technical support for survey. operations on MI and third party vessels. • Management of contractor and service procurement required to support INFOMAR activities (via Framework Agreements, Tendering and EU/EMFAF Projects). • Team management and development in the AMS section, including annual planning and progress monitoring. • Management of INFOMAR communications (external and internal (MI / GSI)). • Project development, management and delivery of European funded projects (JIBS, MESH Atlantic and INIS Hydro), DGMare/EASME Contracts (ProAtlantic Checkpoint, EMODnet Seabed Habitats) and EMFF/ EMFAF Projects (SeaRover, SeaRover Synthesis, National Sediment & Imagery Catalogue, SeaShelf). • Co-Ordination and delivery of AMS habitat mapping expertise to underpin environmental/biodiversity reporting including habitat mapping inputs for National and EU Policy (MSFD, ICES, OSPAR). • Engagement with a broad range of stakeholders (e.g. DECC, DAFM, DHLGH, ORE Sector, OSPAR, UAU, Heritage groups, Tourism & Leisure, GEBCO, Seabed 2030, UNESCO), enhancing visibility of INFOMAR and EMODnet outputs and addressing their requirements through product development. • Irelands representative on ICES SCICOM (International Council For the Exploration of the Seas, Scientific Committee).

Position	Qualifications	Skills	Roles & Responsibilities
GIS Analyst - STO Joined MI - 03/12/2007	MSc GIS BSc Physics	• Data management, validation, quality control of geospatial data, as well as supplying metadata • Data analysis and processing of vector and raster GIS datasets • Preparing digital maps and databases in a variety of formats • Creating visually effective maps and data representation products • Utilizing ArcGIS Online for sharing geospatial data, creating interactive maps, and providing users with dynamic mapping solutions. • Collating, organizing, and managing GIS data and creating mapping products for aquaculture license applications. • Participating in hydrographic and geophysical surveys in Irish Government research vessels	• Providing GIS support to the INFOMAR team and support to related R&D and MI projects. • Integrating multiple INFOMAR data products into an ArcGIS platform • Creating interactive online mapping viewers for ORE project planning and visualization • Compilation of interpretive charts of the seabed for publication. • Contributing to the design and delivery of INFOMAR final deliverables. • Liaising with industry and academic professionals to provide support and data requests for marine projects. • Standardizing, improving, streamlining, and documenting GIS workflows. • Analyzing and compiling data gaps in marine areas for reports and survey planning
Data Manager - STO Joined MI - 21/04/2008	MLitt in Geography	• Program Coordination – planning, organizing, and managing resources. • Publishing spatial data through GIS software's and visualization tool applications • Metadata creation to describe the data • Data quality management: Ensuring high standard documentation are produced for each process • Infrastructure Administration Support: Manage, store and process data	• Responsible for the management & dissemination of INFOMAR data • Support the publishing of data services and products, ensuring they meet the programme needs. • Support the publishing of metadata which helps to organize, find and understand data. • Develop and encourage the adoption of data management best practices through the accredited Institute's Data Management Quality Management Framework, which serves as a guide for our data management processes to provide relevant and trustworthy data. • Support the data request process. • Engage with team to align ORE tool development with ORE survey planning requirements. • Coordinate the data management steering group team to ensure alignment on projects work deliverables using a common framework. • Engagement with key stakeholders to define, communicate and implement the projects vision. • Building and extending a roadmap of where we can look for opportunities where we can continually improve and enhance the practices and processes
Hydrographic Survey - STO Joined MI - 26/05/2006	8,857 MSc Coastal Resource Management BSc Hons in Maritime Studies	• Survey planning, vessel mobilization, dimensional control of INFOMAR hydrographic surveys • Hydrographic data acquisition, processing, and quality control • Technical and scientific reporting • Surveyor - Oil & Gas 3D Exploration Seismic Acquisition • INFOMAR ORE Geophysical Survey Coordination and support • Tender review and processing	• Setup, Acquisition, and processing of INFOMAR hydrographic surveys • Documentation of onboard SOP's • Chief Scientist on INFOMAR surveys • Review of DMQMF requirements and updating SOP documentation. • Support INFOMAR tender review process • Support INFOMAR comms WG • Outreach and TY Programs

Position	Qualifications	Skills	Roles & Responsibilities
Multibeam Data Processor - Joined MI - 06/07/2009	BSc Hons Earth and Ocean Sciences	• Hydrographic and geophysical survey experience in Government, academic, and commercial site surveys • Survey planning, vessel mobilization and multibeam calibration • Hydrographic data acquisition, processing, and quality control • Training delivery in hydrographic and geophysical survey and processing methods • Technical report writing • Geological analysis • Data analysis using geographical information software.	• Processing and storage of hydrographic datasets acquired on a variety of INFOMAR vessels for digital access and chart production. • Appropriate hydrographic QC practices and results are reported and included in tracking documents and survey reports. • Development of new resources for outreach projects, including lecturing and delivery of hydrographic survey and processing training to INFOMAR MSc students. • Developing data processing SOPs to support the Marine Institute's data strategy standards and successful BODC accreditation. • Chief scientist on INFOMAR surveys
Data Analyst STO – Joined MI - 06/09/2023	MSc GIS BSc Physics	• Data and database management • Data analysis and quality maintenance of geospatial data • GIS support and development of spatial services for both raster and vector datasets • Scripting for automation of GIS workflows • Dynamic and interactive map creation and design	• Data Management of INFOMAR Data • Provide quality checks on INFOMAR datasets. • Provide ongoing GIS support to INFOMAR and the wider organisation • Update and publish publicly available raster and vector datasets • Maintain INFOMAR WebMaps and viewers • Integrate INFOMAR data onto ArcGIS and other GIS platforms, including Ireland's Marine Atlas and the new ORE digital tool • Update and improve GIS workflows and documentation • Provide support to the general public looking for INFOMAR data via the Marine Institute's Data request portal
Habitat Mapping STO			• Support to Advanced Mapping Services team in all aspects of marine habitat mapping. • Contribute to delivery of AMS and INFOMAR supported projects (EMODnet, EMFAF etc.). • Development and delivery of EMODNet outputs as required (Storymaps, Infographics, Outreach items, Updates for EUSeaMap). • Collation and delivery to ICES and OSPAR Data Calls. • Integration of multibeam, remote sensing, geophysical and groundtruth data for habitat mapping, and generation of seamless land to marine map products and services. • Compilation and incorporation of ancillary data relevant to identification and delineation of sensitive and/or valued marine habitats. • Liaise with Geological Survey Ireland Marine Survey Unit team, Marine Institute benthic and pelagic information personnel, MSP, MSFD ORE, EMFAF Teams, and DHLGH National Parks and Wildlife Services, and Marine Environment Team to ensure efficient prioritised approaches are in place for all habitat mapping interpretational and operational efforts.

Position	Qualifications	Skills	Roles & Responsibilities
Value Added Exploitation STO			• Support the Advanced Mapping Services (AMS) team in all aspects of INFOMAR and related seabed and habitat mapping services, with an emphasis on Value Added Exploitation and strategic development of products and services. • Development of GIS tools and workflows for improved INFOMAR operational planning, data integration, analytics & visualisation, and data dissemination. • Evolve data related products, services and workflows for specific user requirements (e.g. mapping & monitoring sensitive habitats / marine resource assessment and management / ORE site assessment & monitoring). • Develop data & products addressing above strategic value-added aspects of INFOMAR, through collating data needs, contributing to operational requirements scoping, leveraging cooperative approaches to delivery, and bespoke product development. • Development and dissemination of outreach, education, and communication content, including for social media, Press Releases, and regular website updates. • Liaise with AMS, GSI, MI cross division teams, and external stakeholders to track & align plans, and where feasible to co-develop mutually beneficial products and services. • Support and develop ongoing and future INFOMAR related national and international research projects, including PhDs, Post Docs, H2020, Interreg, EMODnet, & EMFAF.
Programme Administrator			• Secretariat to the INFOMAR Programme Board, and INFOMAR Technical Advisory Committee. • Track project expenditure and provide management with updates as appropriate. • Assist AMS Section Manager in ensuring that all financial, reporting and administrative deadlines are met. • Ensure project accounts and procurement records are maintained, ensuring audit compliancy. • Provide administrative support to Section Manager in managing delivery of the Service Level Agreement related outputs, and collation and circulation of INFOMAR SLA progress reports. • Managing general enquiries to the INFOMAR programme (phone and email). • Provide assistance for supported projects, including preparation of publicity materials, and support for meetings, workshops and conferences as required. • Assist with streamlining programme administration and communication materials.

Marine & Coastal Unit, Geological Survey Ireland

Position	Qualifications	Skills	Roles & Responsibilities
Principal Geologist	B.Sc Hydrography	• Maritime experience from a young age (10) oceanic sailing and thereafter as professional yacht delivery skipper. • Commercial hydrographic experience in the Arabian Gulf with Fugro Middle East • Operations and Project Management ie Procurement/ Equipment Maintenance/Personnel Management/Systems Design etc.	• Skipper (Captain) on many varied vessels. • Party Chief and Project Manager on many varied geophysical and engineering projects offshore from Abu Dhabi for a number of oil companies. • Operations Manager for the INFOMAR fleet of vessels. • Programme Manager for INFOMAR
Senior Geologist – joined GSI in 2001 as Geologist and promoted to Senior Geologist in 2019	MSc (Res) in Geology; H. Dip in GIS and RS; BA Geology	• Extensive hydrographic and geophysical survey experience, • Competent on a wide range of survey related practices, software and methodologies. • Special interests in Satellite Remote sensing, seismic, hydrographic data and costal evolution • Technical and scientific project management and reporting.	• Support management in coastal change activities, including tenders and product development • Support and coordinate the MCU Coastal Change data flow, from data to products. • Supervise and mentor university researchers • Support and contribute to the long-term management & maintenance of INFOMAR and related datasets.
Senior Geologist – joined GSI in 2020.	MSc Oceanography, BSc Geology	• Experienced in hydrographic, oceanographic and geophysical marine survey techniques • Project management • GIS • Procurement • Geological mapping • Geodesy	• Operations Manager for INFOMAR inshore vessels • Managing production of reports and products • Procurement • Communications & outreach • Delivery of lectures for INFOMAR postgraduate training
Senior Geologist – joined GSI in 31/10/2002	MSc in Geographic Information Systems BSc in Geochemistry	• Hydrographic data processing • GIS data analysis and processing • Data Management • Marine Geological Mapping • Project Management	• Manage and coordinate data processing and data management for MCU • Coordinate marine mineral data for EU projects • Participate and contribute to the joint INFOMAR Project Management team and joint INFOMAR Data Management team

Position	Qualifications	Skills	Roles & Responsibilities
Senior Geologist – joined GSI in 2002 as a Geological Assistant, later established to Geologist and promoted to Senior Geologist in 2023	MSc (Res) in Geology & Geophysics; BA Geology	• Extensive hydrographic and geophysical survey experience, with a particular emphasis on nearshore survey with small platforms. • Competent on a wide range of survey related practices, software and methodologies. • Special interests in seismic, hydrographic data quality, geodetics, vessel mobilisation and dimension control/alignment surveys & calibrations. • Experienced at coding custom utilities to meet small scale scientific and business needs. • Technical and scientific project management and reporting.	• Support the Management and development of hydrographic and geophysical infrastructure within MCU including tenders, equipment installations and quality acceptance. • Support and coordinate the INFOMAR hydrographic data flow, from instrument installation, calibration, survey planning, data acquisition, processing and delivery of data and services to end users. • Supervise, mentor and lead survey teams and reporting staff. • Support and contribute to the long-term management & maintenance of INFOMAR and related datasets.

Appendix IV – Stakeholders engaged for review

The following INFOMAR stakeholder organisations contributed their views to this programme review:

Government Departments, State Agencies and Private Sector Businesses that took part in our stakeholder engagement sessions

Department of Environment, Climate and Communications

GSI

Marine Institute

Corio Generation

Lough's Agency

OPW

An Bord Pleanála

Xocean

UK Hydrographic Office

Department of Foreign Affairs and Trade

MERC Consultants Ltd.

The Commissioners of Irish Lights

Met Éireann

Fisheries Ireland

Waterways Ireland

MARA

UCC

Aerial Agri Tech

DHLGH

UCD

UK Maritime and Coastguard Agency

DAFM

Seabed 2030

National Park and Wildlife Service

Bord Iascaigh Mhara

University of Limerick

Department of Transport

Appendix V – Legislative underpinning INFOMAR Activity

Below is a list of local and international legislation that impacts the INFOMAR programme.

Legislation	Area of Operations
Maritime Spatial Planning Directive	Planning
European Union (Framework for Maritime Spatial Planning) Regulations 2016	Planning
Marine Strategy Framework Directive	Environment
European Communities (Marine Strategy Framework) (Amendment) Regulations 2018	Environment
European Communities (Marine Strategy Framework) (Amendment) Regulations 2017 - S.I. No. 265/2017	Environment
European Communities (Marine Strategy Framework) Regulations 2011	Environment
Public Sector Information Directive	Public Sector Data
European Communities (Re-use of Public Sector Information) (Amendment) Regulations 2015	Public Sector Data
European Communities (Re-Use of Public Sector Information) (Amendment) Regulations 2008	Public Sector Data
European Communities (Re-Use of Public Sector Information) Regulations 2005	Public Sector Data
Open Data and Public Sector Information Directive	Public Sector Data
Water Framework Directive	Environment
European Union (Water Policy) Regulations 2014	Environment
European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010	Environment
European Communities Environmental Objectives (Surface Waters) Regulations, 2009	Environment
European Communities (Water Policy) Regulations, 2003	Environment
Access to Information on the Environment	Environment
European Communities (Access to Information on the Environment) (Amendment) Regulations 2014	Environment
European Communities (Access to Information on the Environment) (Amendment) Regulations 2011	Environment
European Communities (Access to Information on the Environment) Regulations 2007	Environment
Strategic Environmental Assessment	Environment
Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011	Environment
Planning and Development (Strategic Environmental Assessment) Regulations 2004	Environment
Environmental Impact Assessment	Environment
European Union (Environmental Impact Assessment) (Petroleum Exploration) (Amendment) Regulations 2019	Environment
European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018	Environment
European Union (Environmental Impact Assessment and Appropriate Assessment) (Foreshore) Regulations 2014	Environment
European Union (Environmental Impact Assessment) (Petroleum Exploration) Regulations 2013	Environment
European Union (Environmental Impact Assessment and Habitats) Regulations 2012	Environment

Legislation	Area of Operations
Habitats Directive	Environment
Infrastructure for Spatial Information Directive	Geospatial
European Communities (Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)) (Amendment) Regulations 2018	Geospatial
European Communities (Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)) Regulations, 2010.	Geospatial
General Data Protection Regulation (GDPR)	Privacy
Data Protection Act 2018	Privacy
Data Sharing and Governance Act 2019	Geospatial
Renewable Energy Directive	Environment
Freedom of Information Act 2014	Freedom of Information
Freedom of Information Act 1997 (Prescribed Bodies) Regulations 2014	Freedom of Information
Freedom of Information Act 2014 (Fees) Regulations 2014	Freedom of Information
Freedom of Information Act 2014 (Fees) (No. 2) Regulations 2014	Freedom of Information
International Convention for the Safety of Life at Sea, 1974 (with annex and final act of the International Conference on Safety of Life at Sea, 1974). Concluded at London on 1 November 1974	Health & Safety
Convention For the Protection of The Marine Environment of The North-East Atlantic	Environment
International Convention for the Prevention of Pollution from Ships (MARPOL)	Environment
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) as amended, including the 1995 and 2010 Manila Amendments	Health & Safety
Sea Pollution (Amendment) Act, 1999	Health & Safety
United Nations Convention on the Law of the Sea (UNCLOS)	Law
United Nations initiative on Global Geospatial Information Management (UN-GGIM)	Geospatial
Continental Shelf (Designated Areas) Order 2009	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1993	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1989	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1977	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1976	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1974	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1970	Maritime Jurisdiction
Continental Shelf (Designated Areas) Order, 1968	Maritime Jurisdiction

Legislation	Area of Operations
Continental Shelf Act, 1968	Maritime Jurisdiction
Maritime Jurisdiction (Straight Baselines) Order 2016	Maritime Jurisdiction
Maritime Jurisdiction Act, 1959 (Straight Baselines) Order, 1959	Maritime Jurisdiction
Maritime Jurisdiction Act 2021	Planning
Maritime Area Planning Act 2021	Planning
Foreshore Act, 1933	Planning
Marine Equipment Regulations	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2019	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2018	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2017	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2016	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2015	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2014	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2013	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2012	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2011	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2010	Health & Safety
European Union (Marine Equipment) (Amendment) Regulations 2009	Health & Safety
Marine Equipment Directive	Health & Safety
Maritime Jurisdiction (Boundaries of Exclusive Economic Zone) Order 2014	Maritime Jurisdiction
Sea-Fisheries and Maritime Jurisdiction Act 2006	Maritime Jurisdiction

Appendix VI – List of standards, methodologies and formats utilised by INFOMAR and their applications

Standards, Methodologies and Formats	INFOMAR Application
IODE Quality Management Framework Guidelines	Quality
Geographic information — Metadata — Part 1: Fundamentals	Metadata
Geographic information — Metadata — Part 2: Extensions for acquisition and processing	Metadata
Geographic information - Metadata - XML Schema implementation	Metadata
Geographic information — XML schema implementation — Part 1: Encoding rules	Metadata
INSPIRE Metadata Implementing Rules (MIR)	Metadata
SeaDataNet Common Data Index	Metadata
ROSCOP Cruise Summary Report	Metadata
European Directory Marine Environmental Datasets	Metadata
MEDIN Discovery Metadata	Metadata
Sensor Model Language	Metadata
Catalogue Service for the Web	Metadata
INSPIRE Discovery Service	Metadata
Geographic information — Data quality	Quality
Quality Management System	Quality
Quality Management System	Quality
SeaDataNet Data Quality Control	Quality
Geographic information — Data product specifications	Data
Geographic information — Observations and measurements	Data
ArcGIS Map Service	Data
ArcGIS Feature Service	Data
ArcGIS Image Service	Data

Standards, Methodologies and Formats	INFOMAR Application
Geography Markup Language	Data
Web Map Service	Data
Web Map Tile Service	Data
Web Feature Service	Data
Web Coverage Service	Data
INSPIRE View Service	Data
INSPIRE Download Service	Data
Network Common Data Form	Data
Geoscience Markup Language	Data
Esri Shapefile	Data
Esri File Geodatabase	Data
Geo Tagged Image File Format	Data
Geo JavaScript Object Notation	Data
Keyhole Markup Language	Data
Esri GRID	Data
ER Mapper Raster Data File	Data
Earth Resource Markup Language	Data
Comma Separated Value	Data
XYZ	Data
Java	Data
Extensible Markup Language	Data
Excel	Data
XYZ	Data
SEG-Y	Data
Text File	Data
International Hydrographic Organisation (IHO) standard for hydrographic surveys	Hydrography
International Hydrographic Organisation (IHO) transfer standard for digital hydrographic data	Hydrography
International Hydrographic Organisation (IHO) Operational Procedures for the Organisation and Management of the S-100 Geospatial Information Registry	Hydrography
International Hydrographic Organisation (IHO) S-100 Universal Hydrographic Data Model	Hydrography

Standards, Methodologies and Formats	INFOMAR Application
International Hydrographic Organisation (IHO) S-23 Limits of Oceans and Seas	Hydrography
International Hydrograpic Organisation (IHO) S-102 Bathymetric Surface Product Specification	Hydrography
International Hydrographic Organisation (IHO) S-122 Bathymetric Surface Product Specification	Hydrography
International Hydrographic Organisation (IHO) S-32 Hydrographic Dictionary	Hydrography
International Hydrographic Organisation (IHO) S-62 List of Data Producer Codes	Hydrography
International Hydrographic Organisation (IHO) S-63 Data Protection Scheme	Hydrography
Data on the Web Best Practices	Data on the Web
Spatial Data on the Web Best Practices	Data on the Web
Occupational Health and Safety	Health & Safety
Ship Systems and Equipment	Health & Safety
Human element, Training and Watchkeeping	Health & Safety
Pollution Prevention and Response (PPR)	Health & Safety
Bathymetry Attributed Grid	Data
GeoPackage	Data
Generic Data File	Data
Microsoft Access	Data
ASCII Grid	Data
Atom	Data

Appendix VII – Bibliography

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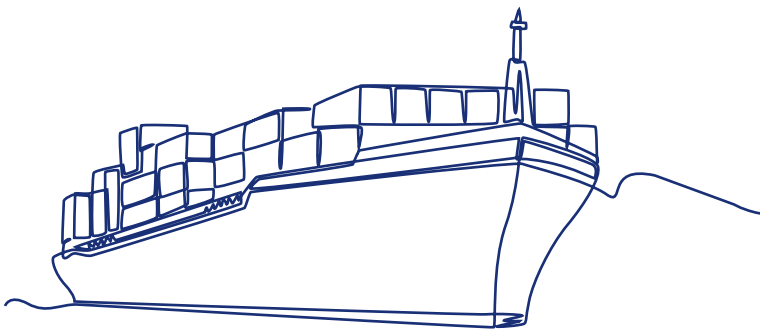

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