



Responsible Land Governance: Towards an Evidence Based Approach

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MARINE CADASTRE IN EUROPE: STATE OF PLAY (NR 355)

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Abstract

Throughout human history considerable efforts and resources have been directed at effectively managing land whereas the marine environment has been given a lower priority. However over 70 percent of the planet's surface is covered by water, the majority of which is in the world's seas and oceans which are vital for supporting human well-being by contributing to poverty eradication, food security, creation of sustainable livelihoods and jobs, and protection from natural disasters (Hoegh-Guldberg, 2015). Oceans and seas are also a valuable asset for the European Union (EU). The EU's maritime economy alone employs more than 5.4 million people, creates a gross added value of just under €500 billion per year, with a high potential for further growth (EC, 2006).

The paper presents the results of a preliminary study on the status of Marine Cadastre across Europe, which was conducted in 2016 for the five leading European organizations on Cadastre, Land Registry, Mapping and Surveying (CLGE, ELRA, Eurogeographics, EULIS, PCC). It aspires to motivate the discussion in the European continent about the benefits of a sound registry system in the marine environment as a basis for legal certainty with multiple benefits in the sector of the Blue Economy and in marine spatial planning as well.

Key Words: Marine Administration System, Marine Cadastre, Marine Spatial Data Infrastructure, Marine Spatial Planning, UNCLOS.



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1. INTRODUCTION

In the first semester of 2014 the Hellenic Republic has undertaken for fifth time the presidency of the European Council. A horizontal thematic on Maritime Policies and Blue Growth was included, among the priorities in the programme of the Hellenic Presidency, aiming to redefine and relaunch EU maritime policies in all their aspects, including security, growth and energy. In the above context, the National Cadastre and Mapping Agency of Greece which undertook the rotating presidency of the Permanent Committee on Cadastre in the European Union (PCC) in the first semester of 2014 included in its priorities the “*Role of Multipurpose Cadastre, of the Geographic Information Systems and the Spatial Data Infrastructures in Maritime Policies and Blue Growth*”. In the same period, i.e. April 2014, the European Parliament endorsed¹ a Directive for Maritime Spatial Planning which would help Member States to develop plans so as to coordinate better the various activities in the sea environment. In June 2014, at the end of the Hellenic Presidency of the PCC, the five leading organizations in Europe on Cadastre, Land Registry, Mapping and Surveying (PCC, ELRA, Eurogeographics, CLGE, EULIS²), acknowledged the great potential of the Blue Economy in the EU and decided to join their forces to collectively better understand the Marine Cadastre concept and its role.

In this regard, a team consisting of experts was founded to carry out a preliminary study, with an orientating character, aiming at reviewing the status of the Marine Cadastre across the European Union, so as to raise awareness about the topic of the Marine Cadastre and to trigger the discussion about its potential benefits for Europe’s Blue Economy. The study was based on primary and secondary research criteria and encompassed three major tasks. The first task included the design and dissemination of a questionnaire through the communication channels of the five (5) Common Vision partners to national experts. The second task comprised of the documentation of the current legislative and policy framework of the European Union as well as of related EU’s initiatives and tools to support maritime policies. The third task encompassed the analysis and synthesis of relevant research, data and information on the topic of the Marine Cadastre worldwide.

The purpose of this paper is to present the results of the preliminary study on the Marine Cadastre in the European Union which was conducted in the above context and to outline the current situation on Marine

¹ European Commission’s Press Release of April 17th 2014 welcoming Parliament’s adoption of Maritime Spatial Planning legislation (http://europa.eu/rapid/press-release_IP-14-459_en.htm)

² Hereinafter are referring as “Common Vision Partners” due to the Common Vision Agreement, signed in 2012 in Cyprus and renewed in Lithuania in 2014, to support all European countries to achieve full coverage and high – quality, transparent and accessible data on land



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Spatial Data in Europe. It aims further to outline the current challenges which converge to the necessity of a comprehensive Marine Information System such as the proper implementation of the 2014/89 MSP EU Directive and of the United Nations Convention of the Law of the Sea (UNCLOS).

However, in the context of the orienting character of the preliminary study, it was out of the scope to provide definite recommendations and conclusions on the design and development of a Marine Cadastre or to provide evidence on the direct links between Marine Cadastre and the Blue Economy, as well as, solid documentation on its' economic effects. This kind of research requires inevitably a different methodological approach as well as organization and implementation of such a project. Instead, this study focused on the identification of the field area in Europe, reaching high level conclusions from the analysis of the current state and proposing initiatives that could provide further insights at a European and national level.

2. DEFINITIONS

The concept of a “**Marine Cadastre**” and the need to “*build a marine regulatory system and a cadastre that underpins offshore rights and responsibilities and sensibly matches its onshore counterpart*” (Robertson et al., 1999) became apparent in in late nineties’ when awareness of the importance of marine natural resources and the recognition of the actual and potential value of a marine environment as an economic resource, led to increased competition for its’ management. Important drivers are considered the enforcement of the United Nations Convention on the Law of the Sea (UNCLOS) in 1994, the concept of sustainable development and the rise of the environmental movement after the Rio Summit in 1992 and the continuous development of Spatial Data Infrastructures.

In the above context, the concept of a Marine Cadastre has attracted interest from several researchers from the geomatics community, as a means to improving the administration of marine and coastal spaces through decision support systems, and lead to increased research efforts towards the development of marine cadastre in various jurisdictions (Sutherland M., 2011).

Following the rise of several research initiatives and pilot projects on the topic of Marine Cadastre, several definitions have been given in the attempt to conceptualize its notion and its content. In this regard, and according to one of several definitions that have been given to the topic. The Marine Cadastre is “*a system to enable the boundaries of seabed rights and interests to be recorded, spatially managed and physically*



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defined in relationship to the boundaries of other neighbouring or underlying rights and interests.”
(Grant, 1999).

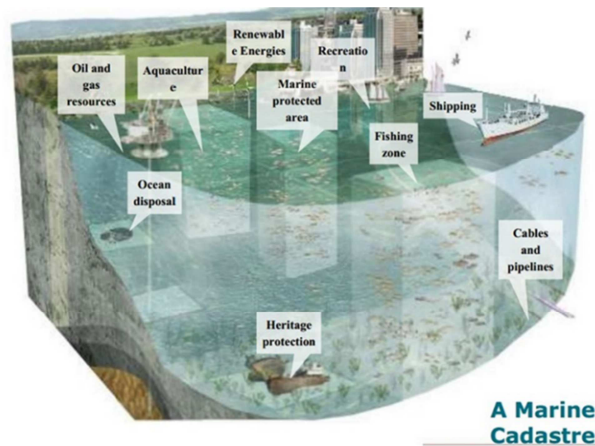


Figure 1: The concept of Marine Cadastre (COINAtlantic, CANADA)

As with Land Cadastre, a second important term, along with the notion of the Marine Cadastre, is the idea of the **marine** or **sea cadastre parcel** which is defined as (De Latte, 2016):

- The volumetric reality of every distinct marine zone (sea surface & water column & seabed or soil & subsoil) with: a) the rights and charges under the UNCLOS b) the patrimonial rights which include rights in rem and
- a fourth dimension, meaning the temporary nature of many particular rights (fixed terms licenses, concessions and leases for mining, production of energy, aquaculture, fishing, etc.).

A considerable portion of the conducted international research on Marine Cadastre considered the similarities and differences between the Marine Cadastre and its counterpart on land. Most of them converge on the fact that the marine environment has unique features that does not apply in the case of the terrestrial environment and therefore to the Land Registry and Cadastre (Binns et.al, 2004, Collier et. al 2001, Widodo M., 2003) though many of the cadastral components such as adjudication, survey, owner rights have a parallel condition in the ocean (Neely et.al., 1998).

Specifically, as regards the similarities, related research (Tamtomo, 2004), argues that as in the land cadastre, the marine cadastre has also been built based on three pillars or benchmarks, as follows:



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- a) the legal pillar (3R: rights, restrictions, and responsibilities); As a part of the legal system (legal cadastre), the marine cadastre provides legal certainty to sea-space development planning, sea parcel rights and leases, and public access to and from the seas.
- b) the technical pillar (surveying, mapping, and spatial infrastructure). As regards the technical pillar, a marine cadastre is designed as a tool and mechanism for providing data and information as a resource for planning and the decision making process, and as legal evidence of a certain sea and marine rights and lease.
- c) the institutional pillar (formal and informal institutions and human resources). The marine cadastre, as part of a public administration system, acts as a public service provider and sea-conflicts resolution.

The following differences between the Marine and the Land Cadastre are the most popular ones according to related academic papers (Collier et.al, 2001, Binns et.al. 2004, FIG, 2006):

- There are virtually no rights of full ownership or exclusive use in marine space
- Ordinary land demarcation techniques cannot apply in the marine environment: Marine boundaries are delimited, not demarcated, and generally there is no physical evidence of “offshore” boundary.
- In the marine environment is common the existence of multiple (overlapping) rights in a single area
- The marine environment is three dimensional – classical 2D simplifications will not suffice.
- Rights can vary with time, adding a fourth dimension to the spatial data.
- The baseline to which many maritime boundaries are related is ambulatory.

The above issues are influencing inevitably the design and development of a Marine Cadastre and are creating new challenges for the involved professionals and related stakeholders. Furthermore, it has been stressed that as with land administration systems which are strongly related to national laws and specific socioeconomic environments and institutional arrangements, it is impossible to adopt a marine cadastre model from one jurisdiction and apply it to another jurisdiction since the concept of a Marine Cadastre is unique for a specific jurisdiction regarding to its characteristics, stakeholders and legal institutional aspects (Collier et.al, 2001).

Closely related to the concept of the Marine Cadastre, is the notion of the **Marine Spatial Data Infrastructure (MSDI)** which *“is the component of an SDI that encompasses marine geographic and business information in its widest sense. This would typically include seabed topography, geology, marine*



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infrastructure, resources utilisation, administrative and legal boundaries, areas of conservation, marine habitats and oceanography” (IHO, 2011).

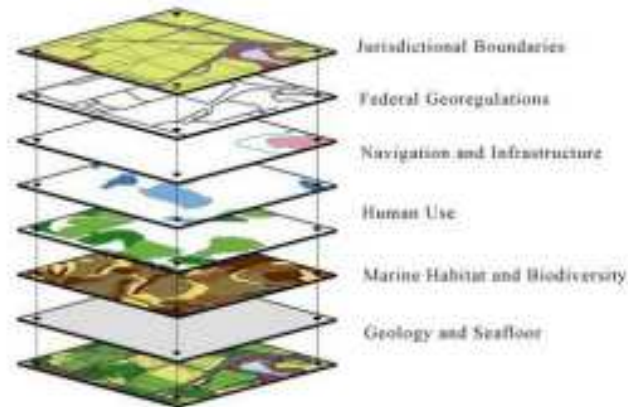


Figure 2: Marine Spatial Data Infrastructure themes (Fowler et.al, 2011)

In fact, the Marine Cadastre is considered as a base layer of a MSDI with fundamental information relating to maritime boundaries and associated rights and responsibilities, regularly updated and maintained (FIG, 2006). The role of the Marine Cadastre as a data layer in a marine SDI has been addressed in the international workshop on Administering the Marine Environment held in Malaysia in 2004. The workshop recommended, in an analogy to a “Land Administration System”, to adopt the term “**Marine Administration System**” for the “*administration of rights, restrictions and responsibilities in the marine environment with the spatial dimension facilitated by the Marine SDI*”. The workshop further recommended that “*a Marine Cadastre is defined as a management tool which spatially describes, visualizes and realizes formally and informally defined boundaries and associated rights, restrictions and responsibilities in the marine environment as a data layer in a marine SDI, allowing them to be more effectively identified, administered and accessed (FIG, 2006)*”. In order to avoid management gaps in the coastal zone, the workshop promoted the idea of a seamless SDI that includes data from land, coast and marine environments to enable the access and sharing of data between those environments to be improved.

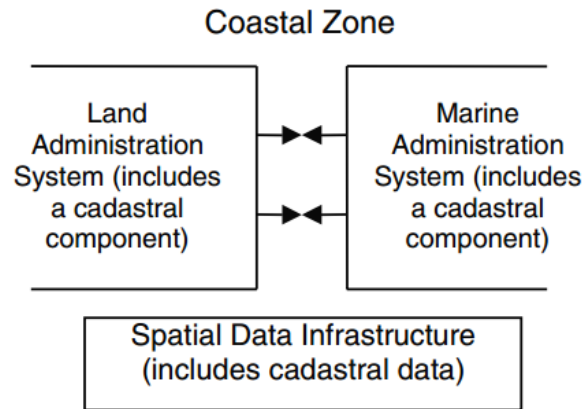


Figure 3: A seamless SDI with data from land, coast and marine environment (FIG, 2006)

As with Spatial Data Infrastructures, the field of the MSDI is very wide with a lot of related technological developments and applications. However compared to SDIs, the Marine SDI has not yet taken a stance nor the terrestrial SDI, because the subject of MSDI is still new (Tares M., 2013). Nevertheless, it has been argued further that even though the number of MSDI themes is currently relatively small in number, it's likely to increase as understanding and new activities evolve in the marine environment (Tares, M. 2013).

3. UNCLOS as an INTERNATIONAL LEGAL BASIS for the MARINE CADASTRE

As being said, the enforcement of the UNCLOS has inevitably influenced the evolution of the concept of the Marine Cadastre. It has been argued (Schlagintweit G.) that 25 among the 330 articles of the Convention are related to geomatics, whereas the provisions of the Convention for the subdivision of the oceans on Territorial Seas, Exclusive Economic Zones and Continental Shelves, each with its corresponding rights and responsibilities, has created a complex multidimensional mosaic of potential private and public interests (Ng'ang'a et al., 2002).

The UNCLOS convention which was signed at Montego Bay (Jamaica) in 1982 and came into effect on 1994³, defines the rights and responsibilities of nations with respect to their use of the world's oceans and seas, establishing guidelines for businesses, the environment, and the management of marine natural resources. The Convention introduced a number of provisions, among them the setting of marine areas and their respective limits, navigation, archipelagic status and transit regimes, exclusive economic zones

³ As of 2017 the UNCLOS has been ratified by 168 parties, which includes 167 states and the European Union.



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(EEZs), continental shelf jurisdiction, deep seabed mining, the exploitation regime, protection of the marine environment, scientific research, and settlement of disputes.

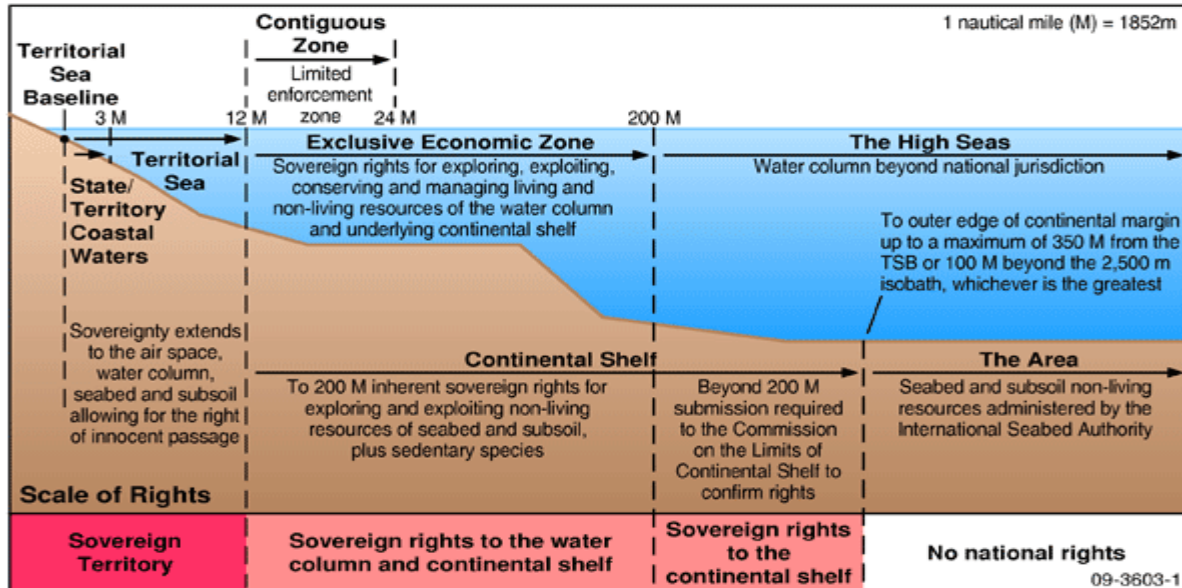


Figure 4: Maritime zones under the UNCLOS (Geoscience, Australia)

According to UNCLOS, the following distinct marine areas or zones, each with its own legal status and rights (assigned to the coastal state, other states and other stakeholders involved) and restrictions, are being measured from a carefully defined baseline:

- **Territorial sea** : is the marine area, up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with the Convention which encompasses air space & sea surface & water column superjacent to the seabed & soil or seabed & subsoil
- **Contiguous zone** – encompasses the sea surface & water column & soil & subsoil – breadth of 12 nautical miles measured from the outer limit of the territorial sea
- **Exclusive economic zone (EEZ)** – encompasses the sea surface & water column & soil & subsoil – breadth of 200 nautical miles measured from the outer limit of the territorial sea
- **Continental shelf** – encompasses only the seabed and its subsoil – breadth of 200 nautical miles (maximum of 350 miles) measured from the outer limit of the territorial seabed
- **High seas** – consists only of the sea surface and the water column subjacent to the surface – beyond the EEZ – beyond any national jurisdiction



- the **Area** encompassing only the seabed and its subsoil under the High Seas – beyond the outer limit of the continental shelf – beyond any national jurisdiction.

Considering that a Marine Cadastre is referring to areas under national jurisdiction, only the Territorial Sea and EEZ are relevant.

4. The EUROPEAN UNION’S POLICY and REGULATORY FRAMEWORK

4.1. INTEGRATED MARITIME POLICY and BLUE GROWTH

On April 1st 1998 the European Union acceded to the UNCLOS, a fact which has inevitably amplified its interest in maritime governance as well as in the administration of marine spaces under its jurisdiction. In 2005 the European Commission included in its strategic objectives for the next five years (2005-2009), the need for an all-embracing maritime policy (EC, 2005). The concept of an **Integrated Maritime Policy** (IMP) of the European Union became officially apparent in the European policy in 2006 with the Green Paper “Towards a future Maritime Policy for the Union: A European Vision for the oceans and seas” (EC, 2006). It was the first time that the land based mentality of EU Policies was reversed symbolizing that Europe is and has always been above all a maritime nation (EESC, 2007). The Green Paper examined factors influencing EU’s competitiveness: the state of the marine environment, scientific knowledge in all areas relating to the oceans, innovation and the expertise of the workforce and inaugurated a consultation process which lasted one year. Building on this valuable input and the conclusions of the consultation (EC, 2007a), the European Commission presented on 10 October 2007, its vision for an Integrated Maritime Policy for the European Union, also known as the **Blue Book** (EC, 2007b).

The Integrated Maritime Policy brings a holistic approach for the coordination of the EU sea-related policies which have been developed separately without taking into account the broader links among them.

The Blue Book (or Blue Paper) laid the foundation for the governance framework and cross-sector tools necessary for an **EU Integrated Maritime Policy**. As regards the tools for integrated policy-making, the Blue Book distinguished three horizontal planning tools of major importance that cut across sea-related sector policies and support joined up policy making:

- **maritime surveillance** which is critical for the safe and secure use of marine space;
- **maritime spatial planning** which is a key planning tool for sustainable decision-making;
- **comprehensive and accessible source of data and information.**



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The Blue Book highlighted the inefficiency of existing planning frameworks that address the emerging challenges from the growing competing uses of the sea⁴. The Commission proposed to set up a **maritime spatial planning**, as a fundamental tool for the sustainable development of marine areas and coastal regions, and for stronger use of **Integrated Coastal Zone Management (ICZM)**, following the 2002 EU's Recommendation⁵.

Moreover, the Commission recognized that the establishment of an appropriate marine data and information infrastructure, as a basis for strategic decision making on maritime policy, is of utmost importance, given the vast majority of data collected and stored all over Europe for a wide variety of purposes. This data should be compiled in a comprehensive and compatible system, and made accessible as a tool for better governance, expansion of value-added services and sustainable maritime development. Having awareness of such a significant undertaking that would need to be developed over a period of years, according to a clear and coherent plan, the Commission committed to proceed, in 2008, towards a European Marine Observation and Data Network (EMODNet) and further to promote the multi-dimensional mapping of Member States' waters, in order to improve access to high quality data.

The notion of the Blue Growth appeared in 2012 and is considered as the extension or the 2nd phase of the IMP so as to contribute to the achievement of Europe's 2020 strategy goals for smart, sustainable and inclusive growth (EC, 2012b). The EU's blue economy represents roughly 5, 4 million jobs and generates a gross added value of almost a €500billion per year whereas further growth is possible in a number of areas. The sectors of the EU's Blue Economy identified with high potential for growth are the following: 1) Blue energy, 2) Aquaculture, 3) Maritime, coastal and cruise tourism 4) Marine mineral resources and 5) Blue biotechnology.

Blue Growth is the long term strategy to support sustainable growth in the marine and maritime sectors as a whole having regard that seas and oceans are drivers for the European economy and have great potential for innovation and growth. It is the maritime contribution to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth.

⁴ i.e. maritime transport, fishing, aquaculture, leisure activities, off-shore energy production and other forms of sea bed exploitation

⁵ 2002/413/EC



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Among the initiatives designed to reinforce the efforts of Member States for a successful blue economy, the Blue Growth policy indicated the maritime spatial planning, the “Marine Knowledge” initiative, and the Common Information Sharing Environment for the surveillance of the EU maritime domain.

These initiatives, which have been developed under the EU’s Integrated Maritime Policy and constitute hereinafter the essential components of the Blue Growth strategy, will provide knowledge, legal certainty and security in the blue economy and underpin and reinforce other existing instruments at a sea-basin and EU scale.

4.2. MARITIME SPATIAL PLANNING and ICZM

Coastal areas⁶ play a vital role in the European economy while they concentrate on a significant part of the EU’s population, the majority of the main urban centers, a large variety of human activities (*e.g. tourism, recreation, holiday housing, fisheries and aquaculture*) and most transport and communication infrastructure facilities. The intensive pressures resulting from the concentration of the abovementioned activities and infrastructures often create threats for coastal ecosystems and natural resources while they also generate conflicts of incompatible uses in the same or adjacent coastal areas.

In this regard, the EU has promoted variously the concept of **Integrated Coastal Zone Management (ICZM)** to be implemented by Member States as a tool for the integrated management of all policy processes affecting the coastal zone, and to further address land-sea interactions of coastal activities in a coordinated way with a view to ensuring the sustainable development of coastal and marine areas. In 2002 the European Commission issued a **Recommendation (2002/413/EC)** which laid down specific principles that the Member States should follow to ensure sound coastal zone management. In 2010 the European Union (Decision 2010/631/EU) ratified the Protocol on Integrated Coastal Zone Management in the Mediterranean to the Barcelona Convention (the ICZM Protocol). The Protocol, which entered into force in 2011 as a mixed agreement, covers issues that fall within both EU competence and the national competence of the Member States. The ICZM is predicted also diversely in other Regional Sea Conventions such as the Helsinki Convention for the Baltic Sea Region (HELCOM) or the Bucharest Convention for the Black Sea.

The **Maritime Spatial Planning (MSP)** aims to address the increasing competition between sectoral maritime interests (*e.g. shipping and maritime transport, offshore energy, ports development, fisheries and*

⁶ The estimated length of the EU’s coastline is almost 70,000 km including the four French overseas departments (French Guiana, Guadeloupe, Martinique, Réunion) which are an integral part of the European Union, but excluding the French overseas collectivities and territories, which are not part of the European Union.



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aquaculture) and environmental concerns, providing a framework for arbitrating between competing human activities and managing their impact on the marine environment and thus enhancing decision making. Therefore, the use of MSP would enhance the competitiveness of the EU's maritime economy, promoting growth and jobs in line with the Lisbon agenda and would provide a basis for simplified permit systems and reduce costs of regulatory and administrative procedures. It would also provide a transparent and reliable planning framework (EC, 2008).

Maritime Spatial Planning is about planning when and where human activities take place at sea – to ensure these are as efficient and sustainable as possible.

A proposal for a Directive to establish a framework for MSP and ICZM was circulated on March 2013 (EC, 2013). However the text of the **Directive** (2014/89/EU) adopted by the European Parliament and the European Commission on 23 July 2014 contained only the MSP component, along with a general stipulation which states that maritime spatial planning “should take into account land-sea interactions.” The inclusion of the Integrated Coastal Zone Management in the relevant Directive 2014/89/EC even though initially perceived, along with Maritime Spatial Planning as a cornerstone of Blue Growth and Integrated Maritime Policy has been hindered due to competency issues among EU and Member States.

According to the relevant Directive (Article 3) “*maritime spatial planning means a process by which the relevant Member State's authorities analyse and organise human activities in marine areas to achieve ecological, economic and social objectives*”. The maritime spatial plans shall identify the spatial and temporal distribution of relevant existing and future activities and uses in the Member States marine waters such as aquaculture and fishing areas, installations and infrastructures for the exploration, exploitation and extraction of oil, gas and other energy resources, minerals and aggregates, maritime transport routes and traffic flows, military training areas, submarine cable and pipeline routes, underwater cultural heritage etc. (Article 8).

With a view to ensuring that maritime spatial plans are based on reliable data and to avoid additional administrative burdens, the Member States are recommended to make use of the best available data and information by encouraging the relevant stakeholders to share information and by making use of existing instruments and tools for data collection, such as those developed in the context of the **Marine Knowledge 2020** initiative and the **Inspire Directive** (2007/2/EC) (*Preamble, point (24), Directive 2014/89/EU*).



According to the provisions of the MSP Directive, the Member States should have transposed the new rules into their national laws by 18 September 2016, and draw up national maritime spatial plans by 31 March 2021.

4.3. MARINE KNOWLEDGE 2020

Central to the Marine Knowledge strategy stands the European Marine Observation and Data Network (EMODnet), which is a single entry point for accessing and retrieving marine data maintained by agencies, public authorities, research institutions and universities throughout the EU and embraces the full cycle, from initial observation through interpretation, processing and dissemination⁷. The development of the EMODnet aims to cover the huge gaps in marine data collection and management across Europe and provide a functional tool for marine spatial planning and better maritime surveillance.

Marine Knowledge enshrines basic principles such as “collect data once and use them for many purposes” and “data should be interoperable, accessible and free of restrictions on use”

The design of the development of EMODnet data infrastructure follows a stepwise approach in three major phases. Currently EMODnet is in the 2nd phase of development with 8 sub-portals in operation that provide access to marine data from the following themes: bathymetry, geology, physics, chemistry, biology, seabed habitats, human activities and last coastal Mapping as a new thematic area still in its early development phase. In the last phase of EMODNET is envisioned to deliver sustainable digital mapping of European sea-beds by 2020.

The most relevant data related to a Marine Cadastre are recorded under the theme of “Human Activities” in the EMODnet portal. The main objective of EMODnet Human Activities is to make information available on the geographical position, spatial extent and attributes of a wide array of marine and maritime human activities⁸ throughout Europe. The portal allows users to view, query and download data and metadata from public and private sources – from throughout Europe - via a single entry portal.

⁷ The European Marine Observation and Data Network (EMODnet) consists of more than 160 organisations assembling marine data, products and metadata to make these fragmented resources more available to public and private users relying on quality-assured, standardised and harmonised marine data which are interoperable and free of restrictions on use.

⁸ Covers geographical information on aggregate extraction, dredging, fish catches, hydrocarbon extraction, major ports, mariculture, ocean energy facilities, telecommunication cables, protected areas, waste disposal (solids, including dredge material, dumped munitions, marine constructions), wind farms, and other forms of area management/designation. Additional information that is anticipated to be added soon includes the status of bathing waters, offshore installations, and hydrocarbon licenses and bidding blocks.



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The Copernicus Marine Environment Monitoring Service (CMEMS) which provides regular and systematic reference information on the physical state, variability and dynamics of the ocean and marine ecosystems for the global ocean and the European regional seas can be regarded as complementary to the EMODnet for the attainment of the Marine Knowledge objectives.

4.4. INSPIRE

The INSPIRE Directive (2007/2/EC) which entered into force on May 2007 establishes an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment. The INSPIRE is based on the infrastructures for spatial information established and operated by the Member States. The Directive includes three annexes that list 34 data themes that define the scope of INSPIRE. Examples of data themes of relevance to the marine community include - but are not limited to - Coordinate reference systems, geographical grid system, Hydrography, Protected sites, Area Management/Restriction/Regulation Zones and Reporting Units, Bio-geographical Regions, Elevation (which includes bathymetry and shorelines), Environmental monitoring facilities, Habitats and Biotopes, Sea regions, and Oceanographic geographical features (JRC, 2015). Even though that differences have been tracked between INSPIRE and EMODnet in terms of scope, policy frameworks and technologies, it seems that the “Human Activities” portal of the EMODNet is relevant to the INSPIRE themes (INSPIRE cluster) “Topographic and Cadastral Reference” and “Facilities, utilities and public services” according to a draft conceptual mapping between INSPIRE themes and EMODNet topics made by the Working Group Data Information and Knowledge Exchange (DIKE) (JRC, 2015). The closer alignment and interoperability between EMODnet and INSPIRE is currently an issue of discussion among the experts working on these two initiatives at European level.

4.5. EUROPEAN ATLAS of the SEAS

Another portal related to marine data is the European Atlas of the Seas⁹ which disseminates cartographic information related to EU's coasts and seas both as maps and open data. The portal is maintained and enriched by JRC with the support of DG MARE. It offers an up-to-date and diverse range of information about Europe's seas, such as *sea depth, underwater features, coastal regions geography and statistics, blue energies, maritime resources, tide amplitude, coastal erosion, fishing stocks, quotas and catches, European fishing fleet, aquaculture, maritime transport and traffic, ports' statistics, maritime protected areas, tourism, maritime policies and initiatives, outermost regions, etc.* The information is displayed in pre-set thematic maps, but users can also switch to 'do-it-yourself mode' and create their own maps by

⁹ http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas



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combining various layers of information. The resulting maps can be exported or printed. However the information is “*of a general nature, not necessarily comprehensive, complete, accurate or up to date, nor appropriate for legal advice*” as it is referred specifically to its disclaimer (EU, 1995-2017).

5. STATE of PLAY OF MARINE CADASTRE in EUROPE

In 2015 a questionnaire intended to gather information on the state of play of Marine Cadastre in Europe was disseminated through the communication channels of the 5 Common Vision partners to all Member States. Answers were provided by representatives of 18 European countries: Austria, Belgium, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Latvia, Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom.

The analysis showed that approximately one third of the responded countries have no initiatives concerning marine cadastre, marine spatial planning or other related marine spatial data infrastructure. The other countries have some sort of information portals concerning sea and coast or are establishing a registry only on the coastal part. According to the answers in the questionnaire, none of the countries have a full-fledged established marine cadastre.

As regards specifically the existing Marine Data information portals in EU Member States, these are either operative or are pilot projects. The websites providing these data are often unknown to the public and the range of the available data is quite limited. The available marine data concerns often Seabed maps (Bathymetry), Navigation information, Fishing rights and Coastline cartography.

One of the countries which seem to have a quite developed Marine Spatial Data Infrastructure is Germany (MDI-DE). It was developed as a supranational network for the integration of marine data from all relevant data sources (Federal or State Institutions, Research organizations). The project was funded by the German Ministry of Education and Research and a cooperation agreement between the partners for permanent operation was made (Melles J., 2015). The portal (<https://www.mdi-de.org>) provides access, visualization and search capabilities to marine data on several themes like Human Activities, Wind Parks, Reserves, Federal Waterways, Bathymetry, Geology etc. and is INSPIRE compliant. The MDI-DE portal is aiming to integrate existing technical developments, among them the spatial data infrastructure from the German Federal Maritime and Hydrographic Agency (GDI-BSH) (<https://www.geoseaportal.de/gdi-bsh-portal/ui>) which provides marine data on complementary themes such as Spatial Planning, Shipping, Water Pollution, Marine Environment, Navigation etc. (Rüh C., Bill R., 2012b).



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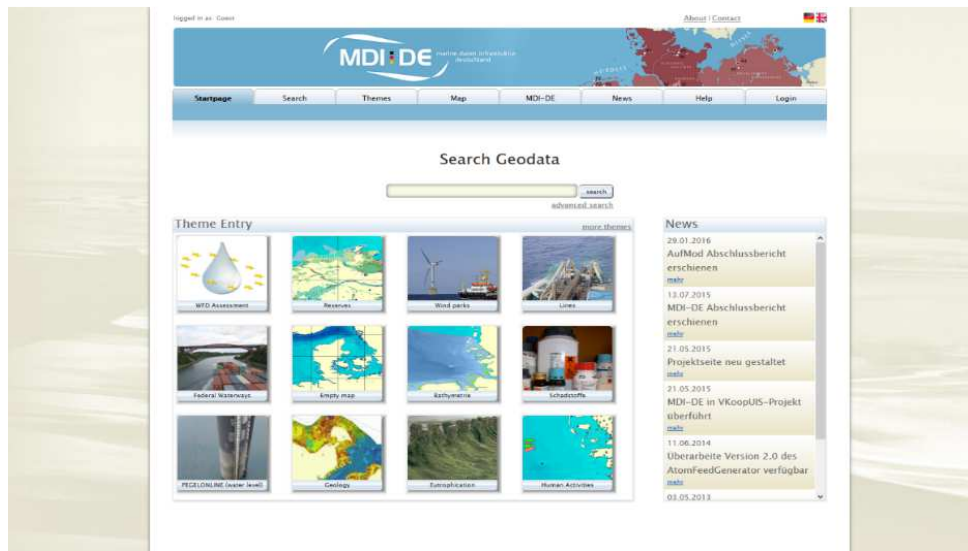


Figure 5: The Marine Data Infrastructure portal (MDI-DE) in Germany

The French National Hydrographic Service website (www.shom.fr) provides bathymetry, tides and currents data. It fulfils INSPIRE directive requirements and it can also display data from other portals due to standardized flows. In France, another project that is still under development is the initiative of the French OGE (Land Surveyors Order) for a Coastal and Sea Portal which is to be integrated to the GEOLAND portal which will therefore become a unique tool to display land, coastal and marine 3D data (Smith, 2016).

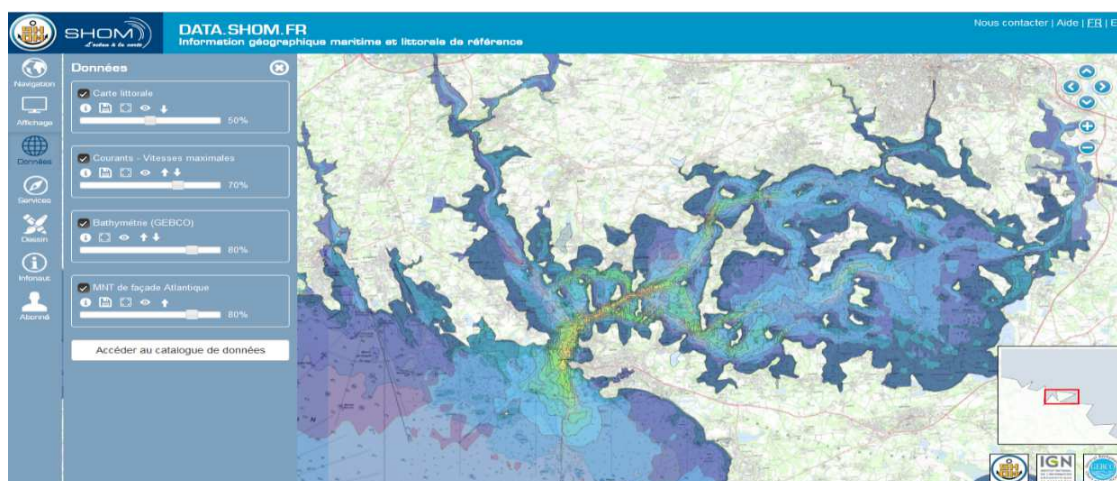


Figure 6: The French National Hydrographic Service portal



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Additionally the questionnaire revealed that *the existing Marine Data information portals have been developed in most of the cases without active involvement of the national Land Registry and Cadastre Organizations*. Exceptions to this are the cases of Denmark and Estonia. In particular the MSDI of Denmark is being developed from the Danish Geodata Agency. In fact Denmark is demonstrating a rapid pace towards the development of a MSDI and “expansion” of the land cadastre to the sea territory. Specifically with regard to the MSDI, in 2015, together with 10 other agencies, the Danish Geodata Agency initiated the implementation of a Danish MSDI. The aim of establishing a Danish MSDI is to make marine spatial data easily accessible and available for comparison and exchange across the maritime authorities for various purposes. In addition, the idea is that the MSDI will be able to provide information on the data in question (metadata), e.g. when the data was collected and updated, how the data can be accessed, the quality hereof and so on. The MSDI will be implemented and authoritative data and associated services will be made available during the period 2015-2016 (<http://eng.gst.dk/danish-hydrographic-office/msdi/>). The Danish Geodata Agency is also responsible for collecting, managing and publishing hydrographic data, including nautical charts and nautical publications and as of 2016, will also have responsibility for registering buildings on the sea territory in the Danish cadastre. These will be registered as simple polygons, at sea mostly in relation to offshore wind turbines and similar structures.

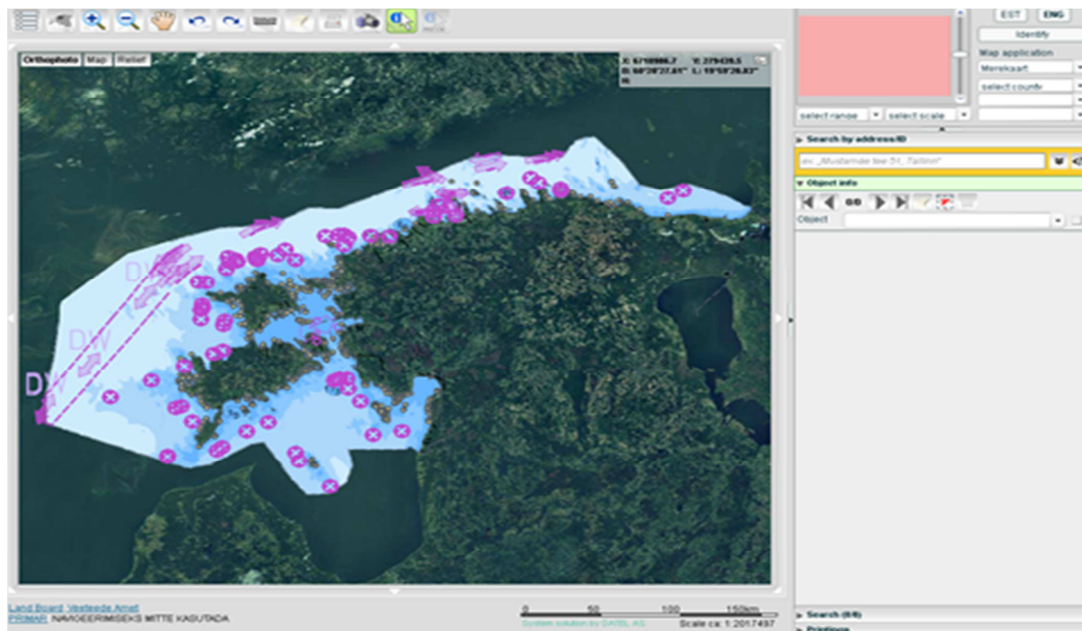


Figure 7: The Marine Areas application in Estonia's Geoportal



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In Estonia the “Geoportal” of the Estonian Land Board hosts a specific “Marine Areas Application” (<http://xgis.maaamet.ee/xGIS/XGis>) which encompasses data for the whole Estonian marine area in Baltic Sea. The available datasets include everything important for marine navigation: Sea depths, Lights, harbor information, buoys, beacons, submarine cables and networks, obstructions, wrecks etc. The lead organisation is the Estonian Land Board which provides the relevant interactive maps while attribute data are coming from the Estonian Maritime Administration.

Examples of portals with marine data which have been developed in the context of pilot Maritime Spatial Planning projects are the ADRIPLAN Data portal (data.adriplan.eu) which shows 71 layers of data on the Adriatic-Ionian Sea of the Mediterranean Sea and the THAL-XOR portal (<http://www.mspsygr.info/thal-xor/>) which is a result of a cross border cooperation between Cyprus and Greece.

The answers provided through the questionnaire demonstrated that the production, collection, maintenance and dissemination of marine data in EU member states, are dispersed to a wide array of actors and there are restrictions on their access. Overall, the experience gained from the analysis of the questionnaire reveals that the development of marine cadastre, and to a lesser extent, marine spatial data infrastructure in Europe is at an early stage whereas only a few respondents were familiar with the term of a Marine Cadastre. It is anticipated however that in the context of the implementation of the Maritime Spatial Planning Directive, more information systems will be developed in the Member States and therefore the need for authoritative data will increase in the near future.

6. WHY a MARINE CADASTRE in EUROPE?

The question remains: What is the relevance and justification for a Marine Cadastre? The most important elements that merit the development of a marine cadastre originate from:

- *The need to implement the UNCLOS thus guaranteeing and securing sovereign state rights in the sea area:* A Marine Cadastre that records obligations and restrictions deriving from the delimitation of marine areas according to the Convention will inform all persons concerned and contribute without any doubt to their enforcement, guaranteeing decisively the sovereign state rights. The information contained in a Marine Cadastre relating to the patrimonial rights that exist in the territorial sea and the EEZ waters and the soil and subsoil of these areas, will also prove very useful in that it will inform the authorities and all other stakeholders about the legal holders (owners, lessors, users, license holders, etc.) and exact content and location of these rights.



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- *The need of publicity and legal certainty in the marine environment to reduce conflicts on the overlapping rights, interests and responsibilities:* Registration is the recording of deeds relating to a) the creation or transfer of rights in rem in immovable goods (or ships) or b) to charges or restrictions encumbering immovable goods (or ships) on specific registers kept at public land or ship registries. Registration is a legally acknowledged proof that the rights of the registered owner, beneficiary, transferee, mortgagee etc. are protected against third parties (deed system) or that the registered person is really legally entitled to the right (title system). Publicity and legal certainty resulting from registration are of paramount importance for a sound real estate market and a performing credit sector, and ultimately for a thriving economy as such. This means that the establishment of a marine cadastre that identifies and describes the physical parcel and its boundaries, should have to be flanked by registration in the registers of the deed creating or transferring the rights, charges or restrictions with respect to the marine cadastral parcel.
- *The need to enhance public revenues deriving from the taxation of marine patrimonial rights and exploitation of marine resources:* As with the land-based cadastre which was primarily established for taxation purposes, likewise, a marine cadastre would lay the foundation for a fair taxation system allowing to tax both sea-related property and sea-generated incomes. In the Exclusive Economic Zone (EEZ), taxation on property and incomes would obviously only be possible following prior registration of the offshore units under a national flag, ideally pursuant to international conventions concluded at the initiative of the International Maritime Organisation (IMO) and/or of the Comité Maritime International (CMI).
- *The need to implement binding legal provisions for maritime spatial planning:* The European Commission attaches much importance to the establishment and implementation of maritime spatial plans by Member States, with the aim of promoting sustainable growth of maritime economies, sustainable development of marine areas and sustainable use of marine resources. A marine cadastre that records general marine spatial planning restrictions, such as shipping routes, fishing and aquaculture zones, disposal sites, energy atolls, corridors for cables and pipelines, nature reserves, etc. will inform all persons concerned and will certainly contribute to the enforcement of the maritime spatial plans.



7. CONCLUSIONS

Our review of the existing literature and implemented projects revealed that the geomatics community (government organizations, professionals and academia) has demonstrated a growing interest to apply land administration techniques to the marine environment in several countries (i.e. Australia, USA, Canada etc.) quite earlier than Europe. Following this interest, several sophisticated web mapping services have been developed based on open and re-use data policies and the concept of the Multipurpose Cadastre. However the majority of the existing projects present a lack of a real marine cadastral registration component appropriate for secure process for transfer of titles, establishment of mortgages etc. (Balla, 2016).

As regards the commonalities of the marine cadastre with land cadastre, there are indeed certain similarities however there are differences as well. If it comes to the system for registration there is an analogy with the land cadastre, though on the other hand, the legal framework differs and the dynamics are entirely different: limited amount of sea parcels and limited amount of transactions. This inevitably affects the solution and appearance of the marine cadastre.

It is widely accepted that the Marine Cadastre is considered as a base layer of the Marine Spatial Data Infrastructure offering fundamental information relating to maritime boundaries and associated rights and responsibilities, regularly updated and maintained. However the study identified that the development of MSDI is at an early phase in Europe. It is anticipated though that as the need for boosting the main five sectors of the Blue Economy gains increased focus at the EU level, more information systems on marine data will be developed in the Member States. Subsequently, the need for authoritative data relating to boundaries and spatial extents of rights associated with human activities in the sea will increase in the near future.

The growing emerging concept of Maritime Spatial Planning since mid-2000 both in academic research as in implemented projects has created misconceptions with Marine Cadastre. As we have seen from our survey, many people refer to Marine Cadastre when they have MSP in their minds. Therefore conceptual clarifications are needed: Marine Cadastre is not Maritime Spatial Planning. MSP is a process determining where and when human activities happen in the sea. The Marine Registry and Cadastre is a system providing all the necessary information (who, how, where) about the 3R's (rights, restrictions, responsibilities) associated with human activities on the marine environment. In fact the Marine Cadastre provides the most important underpinning data sources to enable MSP implementation since the process of planning requires the knowledge of boundaries and related cadastre information. Therefore Marine



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Cadastre can facilitate decisively the process of MSP. However the study identified that there is no kind of reference to the notion of Marine Cadastre in the EU's regulatory framework. In fact, the EU placed an emphasis to Maritime Spatial Planning, as the most appropriate cross cutting tool to achieve legal certainty for all stakeholders in the maritime arena, to enhance the investment climate in Blue Economy Sector and to reduce transaction costs. Consequently, the "spatial dimension" on the administration of the marine environment is being reflected in the 2014/89 EC Directive (MSP), though without any explicit link to the rights which are associated with the human activities in marine areas. The same applies to national legal frameworks where only a few cases were identified with specific reference to registrations in the sea environment.

As regards the EU cross cutting tool of Marine Knowledge, it appears that the most relevant data to a Marine Cadastre are recorded under the theme of "Human Activities" in the EMODnet portal. However the study identified that the information provided through EMODnet portal is of a static nature, more suitable for other purposes (e.g. statistics, planning, research), whereas the legal component (validated and authoritative information about associated rights) does not seem to be fully nor properly developed to support the offshore property market. The same also applies to the spatial component where authoritative and updated data are needed to secure interests, restrictions and responsibilities of Member States, industry and citizens.

Moreover our study revealed that responsibilities and jurisdictions in the marine environment (demarcation of coastline, delimitation of marine areas, granting of rights and permits, concessions, planning, protection) are scattered and shared over a diverse and multiple range of actors (national authorities, institutes, organizations). The same complicated pattern exists in the production, collection, maintenance and dissemination of marine data while restrictions on access have been detected. However we have noticed that the competent national Land Registry and Cadastre organizations have been scarcely so far engaged.

The existing Marine Information Systems (either operative or on pilot basis) in Member States are developed either on the concept of EMODnet or to serve other needs (ICZM strategy, MSP, marine areas' delimitation) but they cannot be considered as a Marine Cadastre. The currently developed (IT) systems and information portals have a rather statistical and descriptive nature. Apart from the fact that typical cadastral information on (ownership) rights and restrictions is lacking, the process of actively maintaining data is not present. The registration is a dynamic process that induces a constant updating (adding,



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changing, deletion) of the registered data. The quick and easy retrieval of data is an important aspect of the IT-system, and that is not a strong point either in EMODnet or in the various national portals.

With growing interest in management of ocean resources and rising public concern about the ocean environment, the Marine Cadastre gains a global recognition as a topic of high interest to many countries in the world, in terms of guaranteeing and securing their national interests from an economic, environmental and social point of view. The experience gained through the preliminary study that has been conducted on behalf of the 5 Common Vision partners and the fact that the land cadastre in many countries is extending to include the coastline while much of the technology that is used in land surveying is applicable to the marine environment as well, showed us that the effective management of the marine environment requires a multidisciplinary approach, while further we understand that land and sea should be treated in a holistic and integrated manner.

To this end, we have the perception that the experience and expertise in the fields of Cadastre, Registry, Surveying, Mapping and Spatial Data Infrastructures should be taken into account to the new topic on the exploitation and sustainable management of the oceans and seas of the European Union. This is a challenge for both land surveyors and for marine industries as well, to embrace the role of surveyors as not just 'land' related, but having the expertise to help spatially define and administer the marine environment (Williamson et.al., 2005). However is a challenge moreover for the Member States and the European Union itself to recognize the need for modern land management systems to enable governance in maritime areas. To this end, a marine cadastre which registers the position and physical extent of rights in a property rights system could be a core element to enable such governance.

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¹⁰ The preliminary study can be found at the web sites of the Common Vision Partners e.g. http://www.eurocadastre.org/pdf/Marine_Cadastre_in_Europe_Brief_Edition_V%201.01_2017.pdf and <http://eulis.eu/news-and-events/story/lets-talk-about-marine-cadastre/>



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CMEMS	Copernicus Marine Environment Monitoring Service
EC	European Commission
EESC	European Economic and Social Committee
EEZ	Exclusive Economic Zone
EMODnet	European Marine Observation and Data Network
JRC	Joint Research Centre
ICZM	Integrated Coastal Zone Management
IMP	Integrated Maritime Policy
MSDI	Marine Spatial Data Infrastructure
MSP	Marine Spatial Planning
UNCLOS	United Nations Convention on the Law of the Sea