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Maritime Accounts in the European Union: Coping with Limited Information

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1. INTRODUCTION

Policy objectives in general and with respect to maritime policy in particular raise the problem of policy makers' requirements for relevant quantitative data with appropriate resolution power and sufficient quality level to enable estimating the potential impacts of policies.

At European Union (EU) level these requirements are justified by the initiatives taken since 2006 and especially in 2015 to improve the preparation of policy and legislation and reduce the regulatory burdens (administrative processes) imposed by the EU legislation. In 2015 the "Better Regulation Package" initiative was adopted. It includes, among other things:

a) Guidelines on Impact Assessment: policy options must be compared on the basis of their economic, social and environmental impacts;
b) Guidelines on stakeholder consultation, which try to pursue the consultation improvement process launched in 2002.

To put it briefly, search for information with a view to improving impact assessment methods has become systematic at the European Commission (EC) during policy preparation phases. The initiatives taken on maritime policy must obviously be seen in this broad context, namely the Integrated Maritime Policy (IMP); an important piece of legislation, the Marine Strategy Framework Directive (MSFD); and an action program, the Blue Growth strategy. In particular, their objectives require collecting maritime economic data among other types of data.

The nature of the maritime data sought by the EC has therefore to be strictly related to the maritime policy to implement. The present article will focus on the economic aspects of this maritime data issue, and examine the methods used for assessing maritime economy in European countries and in the European Union (EU) as a whole, with particular attention to recent progress. The work of the EC did not start from nothing: a small number of EU countries launched the process of maritime database development some years earlier, without interactions with the EC; now the number of developers is sensibly larger. Such projects have influenced the approach of the Commission since the mid-2000s. Conversely, EC's approach is now influential because of the frequent discussions between the EC staff and national experts.

On the basis of national experiences and the main steps of the EC's strategy listed above, the paper will address in turn:

a) The development of maritime databases in some EU countries, their definition of the maritime economy;
b) The different steps of the EU policy initiatives which led the Commission to require data on the maritime economy as a whole;
c) The different steps of EC's approach to an EU-wide integrated maritime database, where most of the difficulties encountered are largely similar to those raised in national projects, except the additional problem of having to include many different countries;
d) The possible options to overcome the main issue of limited information;
e) And the question of identifying emerging sectors of the maritime economy with high growth potential.

The paper will limit its scope to the market economy and economic data based on national accounts standards. The issue of non-market values and ecological services will not be considered herein.

2. NATIONAL APPROACHES IN EU COUNTRIES

The earliest attempts to build up a consistent approach to maritime economic accounts can be traced back to the project to subdivide the US national income accounts into an "ocean sector" and an all-other component (Pontecorvo, Wilkinson et al., 1980). This theoretical approach to ocean accounts was elaborated in the 1970s but the first case study on the maritime economy was developed by the Ocean Resources Management Program, California, in 1993 (Kildow, Baird et al., 2000) and is pursued by the Center for the Blue Economy in the framework of the National Ocean Economics Program (Kildow, Colgan et al., 2014).

In Europe, the first reports on the topic were published a few years later in the 1990s, in a small number of member states with diverse motivations. Some European organizations separately undertook to assess the economic significance of national maritime activities (see Tab. 1), with pioneering reports published by the UK and Italy in 1996 and updated later (Pugh, 2008; Censis, 2011). In France, after a preliminary study commissioned by Ifremer French Institute for the Exploitation of the Sea in 1992-1994, the institute published a report in 1997, periodically updated (Girard, Kalaydjian, 2014). Norwegian and Dutch industry associations published similar reports in 2003 (Wijnolst, Jenssen, Sødal, 2003), so did a Spanish industry association in 2006

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(Innovamar, 2011), and the Irish Marine Institute and Semru/NUI Galway in 2010 (Vega, Hynes, O'Toole, 2015). Regarding regional studies, Schleswig-Holstein and Lower Saxony, German Länder with significant maritime-related industries, were also involved in this domain of assessment (Hegenbart & Partner, 2015).

Some of the above studies were not updated but were followed by sectoral studies focused on maritime transport, shipbuilding and shipping support services, or research, commissioned either by the same funding entities (Dutch Maritime Network, 2005; Federazione del Mare, 2015) or another industry association (Oxford Economics, 2012). These studies are interesting with respect to the methodology used for assessing maritime sectors but remain outside the core topic of the present article.

Table 1. Selected List of Studies on Maritime Economy in Europe[1]

	Country	**Author**	**Funding entity**	**First issue**	**Updates**	**Time period covered**
1	UK	NOC(1)(4) / David Pugh	IACMST(1)(5), Crown Estate(3)	1996	1996, 2002, 2008	1994/5, 1999/2000, 2004/5
2	Italy	Censis(2)(4)	Federazione del Mare(6)	1996	2003, 2011	Around 1992, 2000, 2009
3	France	Ifremer(4)	Ifremer	1997	Biennial	1995-2011
4	Norway and the Netherlands	Dutch Maritime Network(6) and Agder Maritime Research Foundation(4)/ Niko Wijnolst et al.	Dutch Maritime Network and Agder Martime Research Foundation Norway	2003		NO: 1988-1999; NL: 1997, 2002
5	Land Schleswig-Holstein (Germany)	MC, BALance(7) Dr. Hegenbart & Partners(7)	Land Ministry of Science, Labor, Transport and Technology	2005	2008, 2015	1994-2011
6	Spain	CEET(3,4), Innovamar(4)	Public agencies	2006	2011	2005
7	Ireland	Semru/Galway University	Marine Institute(5) and Research Programs	2010	Biennial	2007, 2010, 2012

[1] (1) NOC National Oceanography Centre. IACMST Inter-agency committee for marine science and technology. (2) Censis Centro Studi Investimenti Sociali; (3) CEET Centro de Estudios Económicos Tomillo; (4) Foundation, public education or public research institute; (5) Public agency; (6) Private industry association; (7) Private consultancies.

These studies had specific motivations depending on funding entities: industry associations were interested in assessing the economic weight of their activities (Italy, Norway, Netherlands, Spain); some regional and national authorities were interested in disseminating information on the economic weight of their economy and its maritime share (Schleswig-Holstein); for research and marine science institutions, the aim was to assess the economic weight of the end-users of research products, suppliers of research equipment and infrastructures, or partners in R&D projects (oil & gas industry, marine data processing industry, etc.).

They have similar objectives in terms of delimiting and assessing the maritime economy on a country or region scale, broken down by activities. The assessment is performed using: a) a limited set of basic economic indicators, mostly selected among business indicators, e.g.: turnover or gross premiums written, gross value added and employment; b) additional indicators (monetary or non-monetary) collected from complementary sources, e.g. industry sources: landings tonnage, transported cargo tonnage, etc.

Despite their common objectives, in the absence of common European standards and definitions, these reports were published separately without intended harmonization. Their main differences concern:

a) Definition, coverage and breakdown of the maritime economy (Table 2),
b) Definition of certain maritime sectors, notably coastal tourism,
c) Definition of employment (full time equivalents; or number employed without other specification).

Comparability of reports is limited owing to the diversity of sources. But despite data gaps and limited quality of certain data, these country reports are a significant step towards the acquisition of skills and experience on the design and development of maritime accounts in Europe.

In quantitative terms, the studies show that the maritime economy of European countries accounts for a modest share of the national economy: 1.5% to 2% for France, slightly more for Italy (1.5 to 2.5%), for the Netherlands (3%) and UK (3 to 4%), and substantially more for Norway (7%) and Schleswig-Holstein (12.5%) where maritime activities are essential components of the industry and service mix.

Some of these studies use input-output matrices to estimate indirect impacts of maritime activities on the national economy (e.g. Censis, 2011; Innovamar, 2011). However this paper will be limited to the valuation of maritime activities

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(direct impacts); the methodology section below will not examine the estimation of indirect impacts.

Table 2. Coverage of Maritime Economy by Selected Studies[2]

Study number (refer to Tab. 1):	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Seafood (1)	F	F	F		F	F	F
Seafood wholesale and retail trade	F	F	F		F		F
Offshore minerals (2)	F		P			F	
Offshore oil & gas exploration & production	F			F		F	
Offshore oil & gas related support services	F		F	F	F		
Marine renewable energy, coastal energy	F		F		F	F	F
Shipbuilding & repair (3)	F	F	F	F	F	F	F
Boat building & repair (3)	F	F	F	F	F		F
Submarine cable & pipeline manufacture			P				
Marine biotechnologies			P				F
Sewage treatment and material						F	
Maritime works (4)	F		F	F	F		F
Tourism / accommodation and restaurants	F		F				
Tourism / operators, travel agencies	F		P			F	
Tourism / cruise & tourist spends in call	F	F	F		F		F
Tourism / water sports, yachting, leisure (5)	P	F	P	F	F	F	F
Seaports, logistics and related services	F	F	F	F	F	F	F
Maritime transport - freight and passengers	F	F	F	F	F	F	F
River ports & inland shipping			F	F			
Ship and equipment leasing and trade			F			F	F
Marine insurance	F	F	F	F		F	F
Financial services, banking	F	F		F			F
Marine engineering and R&D services (6)			P	F	F	F	F
Coastal services (health, legal, other)							P
Public defense & security	F	P	F	F	F	F	
Traffic control & safety, salvage, customs	F		F			F	F
Education	F		F		F	P	
Coastal & marine environment protection			F				
Marine science, operational oceanography	F		F	F	F	F	F

3. EU MARITIME POLICY AND REQUIREMENTS FOR AN EU-WIDE ECONOMIC DATABASE

Since the 2000s, unlike EU countries, the requirements of the European Commission (EC) for maritime economic data were systematically policy

[2] F full coverage; P partial coverage (1) Fisheries, aquaculture, processing; (2) Including salt and marine aggregates; (3) Including marine equipment; (4) Including cable and pipeline laying, and river works; (5) Including marinas and sport fishing; and (6) Including shipping route survey, consultancies, classification societies, naval architecture.

driven. This was in line with EC's working procedure: EC's requirements for statistics from Eurostat, the statistical office of the EC, have to be justified by a legal base or an EC policy initiative (see Eurostat, 2014: priority area 08, "Maritime policy statistics", p. 152).

An important example of EC policy initiative was the "Blue Book" published in 2007, i.e. the communication from the EC on the IMP Integrated Maritime Policy (EC, 2007a). The IMP referred to the guiding principles of the "Lisbon Agenda" (promoting competitiveness and employment growth) and the "Göteborg Agenda" (promoting sustainable and job-generating growth and social cohesion). These principles were major drivers for the four main policy orientations of the Blue Book:

a) Boost productivity in key maritime sectors (e.g. shipping and ports, marine research);
b) Manage maritime activities in terms of safety and security, and space and resource consumption;
c) Manage marine environment (water and environment monitoring; climate change and air pollution impacts mitigation);
d) Improve working conditions in maritime activities, and quality of life in coastal zones.

The Blue Book covered a wide spectrum of maritime sectors, including transport, fishing, marine science, environment and resource management, and land use. The "Action Plan 2008-2010" (EC, 2007b) accompanying the Blue Book drew up the list of measures to be adopted in the short term. One of its actions included the development of "an integrated socio-economic database for maritime sectors and coastal regions". Actually, the question of the need for economic information on maritime sectors and on their environmental footprint was raised earlier, during the preparation of the Blue Book, and was a topic of discussion between stakeholders and the EC staff (see Azevedo, Desrentes et al., 2006, Vol.2, p.5). Just after the publication of the Blue Book, the EC commissioned a study for the development of a maritime database (Kalaydjian ed., 2009). The work was achieved in 2009, in the timeframe of the Action Plan.

Another key driver for the further development of a maritime database was the MSFD Marine Strategy Framework Directive (EC, 2008b), adopted as a major environmental component of the IMP, alongside the Water Framework Directive (EC, 2000). The two directives overlap as the MSFD concerns coastal and deep sea waters and the WFD is related to river basins, including surface waters, groundwater, estuaries and the shoreline. The MSFD was an ambitious

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directive on the management of marine waters and raised the question of data requirements. It provided that member states should develop, for their marine waters, strategies applying an ecosystem-based approach, and aiming at achieving or maintaining "good environmental status" (GES) in the marine environment by 2020. In terms of economic information, the key point in the Directive (Article 8) is that the GES should be determined after an initial assessment of marine waters including:

a) an analysis of the current environmental status of waters,
b) an analysis of the predominant impacts and pressures, including human activity, on the environmental status of those waters,
c) an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment.

As the MSFD did not impose any methodological standard for the economic and social analysis, a Guidance Document was issued by an informal Working Group on the Economic and Social Assessment (WG-ESA, 2010) made of marine environment experts and stakeholders of the EU. As a non-legally binding document, the Guidance proposed different examples of assessment methodologies. But it proposed in particular a "marine water accounts approach". Marine water accounts would be designed to describe economic sectors using marine waters in specific regions or marine zones. Sectors would be assessed, if possible, in terms of turnover, intermediary consumption, value added, number of employees and wages: the objective was to obtain comparable accounts for marine regions and sub-regions[3].

The above shows that the IMP and the MSFD had common requirements for economic information on economic activities generated by marine and coastal water uses, and for environmental information on the impacts of uses. The difference between the two is that the MSFD makes a focus on an economic assessment of water uses on a regional and local scale while the IMP's scope is wider; the acquisition of local data is critical for the MSFD initial assessment.

The third major example to mention is the Blue Growth strategy. A communication from the EC was published in 2012 on the growth potential of emerging sectors of the maritime economy and their potential contribution to the economic growth of the EU in 2020 and beyond (EC, 2012). The objective was to implement a policy supporting the blue economy which "offers new and

[3] Art. 4 of the MSFD lists the four marine regions of the EU: NE Atlantic and Mediterranean (each of these being subdivided into four sub-regions), and Baltic and Black seas.

innovative ways to help steer the EU out of its present economic crisis". This project had to be seen not only as a component of the IMP but also as the maritime dimension of "Europe 2020", the EU's ten-year job and growth strategy launched in 2010 and aimed at a "smart, sustainable and inclusive economy".

With this new policy initiative, the question of emerging, high potential value added sectors received increased prominence at the EC (marine renewable energy, mineral resources, blue biotechnologies). An economic study (Ecorys, 2012) was commissioned by the EC with the objective of identifying and assessing emerging sectors of the Blue Economy in terms of growth potential. Shortly thereafter the EC raised the problem of barriers to Blue Economy development in another communication (EC, 2014). This ten-page document briefly set out EC's plans for addressing gaps in knowledge on the state of oceans and shortcomings in Europe's innovation strategies, for disseminating marine science originating knowledge to foster innovation in private businesses, and for proposing solutions to the lack of skilled workforce in new marine technologies in private businesses and public organizations. In mid-2015 the development of a maritime database for the EU was put out to tender: the terms of reference paid great attention to the emerging sectors of the Blue Economy.

The initiatives listed above highlight the role of EU policy as a permanent driver for maritime economic data requirements on Europe and region scales. In addition, a study has to be mentioned given its potential implications on EC's database development methodology. The Marnet project (Foley, Corless et al., 2014) was funded by EC's European Regional Development Fund / 2007-2013 Program for the Atlantic Area. Partnership included a set of Atlantic regional organizations and research units. The objectives of the project were:

a) to establish a marine socio-economic network which will collate and use comparable data to support marine economic development in the Atlantic Area;
b) to construct a database of comprehensive, comparable and reproducible marine economic data for the Atlantic regions;
c) to create an atlas of marine economic indicators publicly available;
d) to put in place practical initiatives in partner regions utilizing the database and the atlas.

The project was not conceived by the EC but by regional stakeholders and research centers; it was justified by partners' interest in combining their experience on maritime economic data collection.

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4. EUROPEAN APPROACH TO AN EU-WIDE MARITIME ECONOMIC DATABASE

The EC's and database users' approach to an EU-wide maritime economic database evolved progressively, building on the step-by-step experience acquired at the EC and in member states. The first step was a study launched in 1997 by the EC and carried out by two consultancies (PRC & ISL, 2000):

a) The report made a stocktaking of EU member states' maritime economy studies and databases developed on a national scale;

b) described the maritime economy, broken down into 17 activities (see *PRC & ISL Study 2000: Breakdown of the Maritime Economy* in Supplemental Material);

c) made a benchmark of the 15 member states of the EU plus Norway in terms of maritime activities;

d) developed a dataset cross-referencing activities with countries and using three indicators: turnover, GVA and employment (number of persons employed), estimated as of 1997;

e) used an input-output matrix to calculate total value added and employment generated. Overall, the value added of maritime activities for EU-15+Norway was estimated at almost 1% of the gross domestic product (GDP) of this group of countries as of 1997.

In terms of methodology, some remarks must be made:

a) The study used a common coverage of activities for all countries and common indicators. This was a step towards an EU-wide maritime database.

b) The set of 17 activities included marine equipment and inland shipping but excluded coastal tourism (accommodation, restaurants and water sport services except marinas).

c) Certain sectors with a diversity of activities (support services, R&D offshore supply) remained difficult to analyze in economic terms.

The second step - the IMP database - built on the approach elaborated in the PRC & ISL study. The terms of reference started from the same coverage of the maritime economy but required major changes: a) the coverage had to be in line with the EU classification of economic activities; b) it had to include tourist services; c) it had to include a regional breakdown of activities and in particular to report on "maritime regions". Additionally, at Eurostat staff's request the

IMP database had to include collected data only, excluding estimates from collected data.

The structure of the final database was built on three dimensions: sectors, territories and indicators:

1. Sectors: the NACE statistical classification of economic activities in the EU[4] was used to identify maritime sectors by codes. The categories of maritime activities selected for the IMP database were: a) exploitation of marine resources: living resources, energy and minerals; b) ship and boat building & repair and other manufacturing activities; c) transport and related services; d) engineering, control, monitoring, security, safety, R&D, education and other maritime services; e) coastal tourism services. Overall, 106 NACE classes[5] were incorporated into the IMP database, few of which were fully maritime (Tab. 3) and the majority partially maritime.
2. Territories: the geographical dimension was based on Eurostat's statistical classification of the EU territories (the NUTS)[6]. The NUTS was used to delimit the geographical extent of maritime activities.
3. Indicators: the NACE classes were assessed using key economic and social indicators. These were: number of enterprises, gross value added (at basic prices and factor cost), purchases of goods and services, personnel costs, employment (number of persons employed and full-time equivalents), purchases of energy products, turnover, production value, growth rate of value added. In addition, external trade data were collected.

[4] The NACE is in line with the ISIC International classification of industries, developed and used by the United Nations. In the latest version of this hierarchical structure (2008), the set of activities is subdivided into 21 sections which are subdivided into 88 divisions, in turn subdivided into 272 groups which are subdivided into 615 classes, the finest level of the NACE. Each member state implements its own national version of the NACE.

[5] The IMP database used version 2003 of the NACE.

[6] NUTS: three-level hierarchical classification whereby the territory of a member state is subdivided into a whole number of NUTS 1 "regions", each of which being in turn subdivided into a whole number of NUTS 2 regions, and so on for NUTS 3 regions. The NUTS is a compromise between the institutional breakdown of member states' territories and statistical requirements for getting sufficient homogeneity in terms of population size. Data reporting to Eurostat is mandatory for NUTS 0 (the country) to NUTS 3. NUTS 3 units are further subdivided into "Local Administrative Units": two levels of LAU (LAU 1 and LAU 2) for which statistical data reporting is not mandatory.

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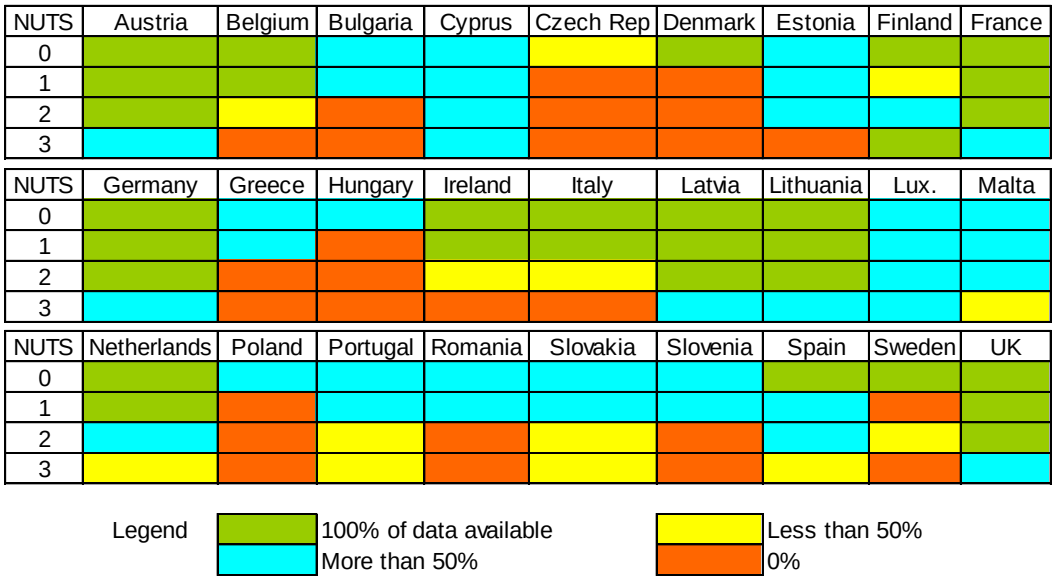
Table 3. Fully Maritime NACE Classes

Section	Division	Class	Description
A	3	3.11	Marine fishing
A	3	3.21	Marine aquaculture
B	8	8.93	Extraction of salt
C	10	10.20	Processing and preserving of fish, crustaceans and mollusks
C	30	30.11	Building of ships and floating structures
C	30	30.12	Building of pleasure and sporting boats
C	33	33.15	Repair and maintenance of ships and boats
F	42	42.91	Construction of water projects
G	47	47.23	Retail sale of fish, crustaceans and mollusks in specialized stores
H	50	50.10	Sea and coastal passenger water transport
H	50	50.20	Sea and coastal freight water transport
H	50	50.30	Inland passenger water transport
H	50	50.40	Inland freight water transport
H	52	52.22	Service activities incidental to water transportation
N	77	77.34	Renting and leasing of water transport equipment

However, the selected indicators assessed NACE classes regardless of the nature of the activities (maritime or not) included in these classes. The outcome was a database which did not describe the maritime economy properly speaking but rather the NACE classes (fully or partially maritime) which included maritime activities. The exercise had then a conventional aspect, depending on the definition of NACE classes . The next section will come back to this problem. Depending on the state of progress in each EU country, the coverage of maritime NACE classes was more or less complete (Table 4, next page).

Table 4. Coverage of the IMP Database per EU Member State



Source: Kalaydjian ed. (2009)

After the publication of the final report (Kalaydjian ed., 2009), the studies published by Eurostat in relation to the EU maritime economy (Collet, 2010; Collet, 2013) were limited to population aspects in coastal regions and to maritime activities corresponding to the fully maritime NACE classes as listed in Tab.3. This was an indication of Eurostat's preference for limiting the analysis to entities for which data are readily available and periodically updated. The picture of the maritime economy resulting from this option remained inevitably limited.

The third step was the initial economic and social assessment (ESA) introduced in section 2. The exercise was of quite different nature from the two former: it was not about a maritime database requested by the EC but rather an assessment on a regional or local scale to be carried out by member states. It consisted in an economic assessment of water uses in marine sub-regions (i.e. on the scale of groups of NUTS2s or NUTS3s), as provided by the MSFD. This was an opportunity for member states to test the availability of local data on maritime sectors in coastal regions, and for the EC to benefit from additional information in terms of local data availability. The assessment methodology was left up to member states in the absence of shared standard. It is therefore difficult to draw general conclusions from the exercise.

France's working group subdivided the MSFD economic and social assessment into two categories: water uses and degradation costs. Regarding

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water uses, the objective was to carry out an analysis of maritime activities inspired by Ifremer maritime economy reports (see section 1). The assessment was made on a marine sub-region basis by combining, on one hand, national and local economic data collected from France's national statistical institute (NSI) and complementary market or non-market indicators assessing the local economic significance of maritime activities (e.g. port throughput, number of hotel rooms, number of marina berths).

The deliverables included a set of reports - one per marine sub-region. Each report included a series of fact sheets on maritime sectors. Other fact sheets described the analysis of degradation costs: this topic goes beyond the scope of the present article.

The limits of the MSFD economic and social assessment was that it remained a national exercise, not harmonized at EU level.

The fourth step to mention in this description is the Marnet project (see section 2) and its economic and social maritime database. The project set out to harmonize, in a group of EU member states, the assessment of maritime activities. This database also included population data which will not be detailed herein. As regards the economic part, the framework of Marnet was developed using that of the IMP database as a starting point, in particular its three-dimensional structure: sectors, geographical units and indicators.

- Sectors: the NACE remained the fundamental tool for a systematic coverage of maritime activities; the list was limited to 55 NACE classes (see *Marnet Project: Selected NACE Classes* in Supplemental Material).
- Geographical units: the objective was to collect national, regional and local data if possible.
- Indicators: the work was limited to collected data (from Eurostat, NSIs, public agencies and industry associations): estimates were excluded because of the difficulty to standardize an estimation methodology for Atlantic member states, given the number of estimates needed for a sufficient coverage.

Another important option in terms of indicators was to combine the collection of business data and proxies. Proxies were understood as physical or monetary indicators used as substitutes for, and assumed to be sufficiently correlated to, missing business indicators or to production capacity (e.g. fish landing tonnage, yearly number of cruise passengers transported, estimated number of beach visitors, number of hotel rooms, and tonnage of waterborne

transported cargo). The aim of proxy collection was to partly offset the business data gap problem regarding the maritime subsets of partially maritime NACE classes.

- Business data and proxies were collected at NUTS0 level and, if possible, on regional and local scales at NUTS2, NUTS3, LAU1 and LAU2 levels. Proxies (Tab. 5) were sourced from Eurostat, national administrations, public agencies and industry associations.

Table 5. Examples of Proxies in the Marnet Database

Class	Description	Proxies
03.11	Marine fishing	· Landing tonnage / NUTS2 · Landing value / NUTS2 · Number of vessels / NUTS2 · Number of under 12m, 12-24m and over 24m vessels / NUTS2
35.11	Production of electricity	· Installed capacity of offshore wind turbines/NUTS2 · Installed capacity of coastal wind turbines/NUTS2
49.50	Transport via pipeline	. Pipeline length / NUTS0 and NUTS2. . Yearly volume of crude oil and refined products transport via pipeline / NUTS0 and NUTS2.
50.40	Inland freight transport	. Overall traffic tonnage / NUTS0, NUTS2
55.10	Hotels and similar accommodation	. Number of hotel nights / NUTS2, NUTS3 . Number of hotel rooms / NUTS2, NUTS3
85.42	Non-Tertiary education	. Number of marine related postgraduate courses / NUTS0 . Number of marine related undergraduate courses / NUTS0 . Number of universities offering marine related courses / NUTS0
93.29	Other amusement and recreation activities	. Number of berths and mooring places / NUTS2, NUTS3 . Number of marinas / NUTS2, NUTS3

Source: online Marnet Atlas (http://marnet.locationcentre.co.uk)

In summary: from 1997 to 2015 EC's step-by-step approach started from a basic overview of maritime activities characterized by a limited set of sectors

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and indicators, and, in building on accumulated experience, moved towards: 1/ a comprehensive coverage of maritime activities following the NACE; 2/ a geographical coverage based on the NUTS; 3/ an extended list of business indicators including turnover, gross value added and employment but also income distributed, sectoral growth rates and exports; and 4/ the use of proxies to complement business data.

Member states contributed to this process as national reports provided experience on the development of maritime databases and on methodological issues. Some of these issues are addressed in the following section.

5. METHODOLOGICAL ISSUES

A maritime database for the EU shares common issues with similar databases for member states, in relation to its three dimensions: sectors, territories and indicators. These issues are not much different from those analyzed by Colgan (2007) for the NOEP database. Most are explained by limited information i.e. the lack of, or the high cost of acquiring, a full set of detailed indicators for sectors and territories. At EU level they are compounded by the need for a strict inter-country harmonization of the database and the practical difficulty to have it because of differences between member states in terms of data sources and data collection constraints.

5.1. Sectoral Coverage: the Scope of the Maritime Economy

A comprehensive coverage of the maritime economy requires a systematic stocktaking of sectors in an orderly manner. Some papers proposed a categorization of maritime sectors according to several criteria among which their links with the marine and coastal environment (Pontecorvo, Wilkinson et al. 1980; Luger, 1991); they were followed by more recent attempts (PRC-ISL, 2000; Foley, Corless et al., 2014; Kalaydjian, 2014). A breakdown inspired by Luger (1991) and adapted for the Marnet database framework permits to identify:

A- Maritime-specific activities use marine resources and the essential physical and spatial characteristics of the sea. They are performed at sea or near the sea and include: resource extraction; sea water use: electricity plants using sea waters as heat sink, renewable energies, defense, ocean survey, marine science, ocean observing and coastal water monitoring; sea space use: transport and ports, cables, pipelines, maritime works; seascape and shoreline-scape uses: cruise, boating, nautical sports and beach visiting.

B- Maritime-linked activities are suppliers and customers of the maritime-specific sector. They are not necessarily performed at sea or in coastal zones. They include essential and complementary activities.

B1- Essential activities are vital for the maritime-specific sector and, conversely, would not exist in the absence of the latter: seafood processing and trade, ship and boat building and repair, ship scrapping and recycling, ship cleaning, marine equipment, offshore oil & gas services, services incidental to transport and ports, coastal accommodation and restaurants, safety, signaling, education and training, marine environment protection.

B2- Complementary activities are important suppliers and customers of the maritime-specific sector; they can develop in the absence of the latter and have non-maritime markets: marine biotechnologies, clothing industry, river civil engineering and construction, travel agencies, urban & beach cleaning, inland navigation and harbor operations.

C- Coastal activities include a diversity of businesses located in coastal areas, namely coastal construction, wholesale or retail trade businesses, real estate, renting and leasing, legal, banking and health services. They do not necessarily have a maritime nature but are "impacted" by specific and linked activities. They also include raw material processing units such as petrochemical and steel-making units located in seaport zones.

Specific and linked-essential activities are covered by most maritime economy reports. But the above breakdown highlights some remaining issues that matter for an EU-wide coverage:

- Regarding complementary activities, how far downstream and upstream in value chains to extend the coverage? In other terms, how to delimit the notion of complementary activity?
- Regarding coastal activities, how to delimit the coverage of businesses in coastal zones?

To these questions there is no general response which can be supported by pure economic and social arguments. Any alternative to a treatment on a case by case basis would require a convention: database developers should agree on a delimitation of the maritime economy with respect to its sectoral extension in value chains. In most national reports, for instance, among "coastal activities" only linked-essentials are covered: the convention is implicit.

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5.2. Sectoral Coverage: the Problem of Partially Maritime Activities

The NACE is commonly used by national and EC maritime economy reports. Like its equivalents in North-America (NAICS) and in Australia and New-Zealand (ANZSIC), the NACE is a consistent tool to classify maritime activities without overlap. But, regarding the coverage of the maritime economy, the NACE raises issues related to mixed classes, mixed businesses and mixed products. 1) Mixed (partially maritime) NACE classes. A typical problem is that a number of maritime activities are included in partially maritime NACE classes, which include maritime and non-maritime activities (e.g. the cargo handling class includes port and other than port cargo handling). These classes are documented by the EU Structural Business Statistics (SBS) in terms of business indicators while their maritime subsets are not separately reported. For the maritime subsets of NACE classes not listed in Tab.5, no data reporting standard is available from the SBS. 2) Mixed businesses. Enterprises' output can combine maritime and non-maritime products (services or goods) (e.g. a company's electric or telecom cable production can be partly designed for submarine systems and partly for the construction industry). 3) Mixed products. The same product can have maritime and non-maritime markets (e.g. oil and gas engineering services can have onshore and offshore applications).

Therefore the method suggested by Pontecorvo, Wilkinson et al. (1980) to subdivide GNP into an ocean and a non-ocean sector raises practical difficulties. It is based on the assumption that the value added originating in each product sector of national accounts can be defined as the sum of two ocean and non-ocean terms: a_{ij}, where i = 1 to n and j = 1,2, is the value added of product sector i originating from the spatial sector j (= 1 ocean or 2 non-ocean). In other terms, an enterprise of sector i has a value added included in the ocean sector (i.e. contributing to a_{i1}) if its primary activity is classified as "ocean" on the basis of supply- and demand-side criteria: in brief terms, the primary activity uses inputs - resources or space or waters - from the ocean (supply-side criteria); or meets a demand significantly attributable to the ocean, or is located near the ocean - in coastal zones to be defined (demand-side criteria). If not, the value added is non-ocean and contributes to a_{i2}. The term a_{ij} is then defined under "consistency conditions" resulting from the definition of national accounts:

$$(1)\ a_{0j} = \sum_{i=1,n} a_{ij} \ ;\ (2)\ a_{i0} = a_{i1} + a_{i2} \ ;\ (3)\ GNP = \sum_{i=1,n} a_{i0} = \sum_{i=1,n\ j=1,2} a_{0j}$$

From a national accounts standpoint - i.e. with the purpose of collecting, not estimating, sectoral business data - the question is under which practical

conditions the above breakdown is feasible. This will depend on whether each enterprise of a given product sector can be classified as ocean or non-ocean. To do this, the classification of products by activity (CPA [7]) can provide information through a set of products (i.e. goods or services) corresponding to each NACE class (EC, 2008a). CPA allows testing the feasibility of defining maritime sub-classes as part of partially maritime classes. Below are three examples of CPA products to illustrate that point.

"Cargo handling" (NACE class 52.24) is a mixed class as said above. Four CPA services are related to it: "Container handling services at ports", "Other container handling services", "Other cargo handling services at ports", "Other cargo handling services". Two services are thus maritime from a demand-side standpoint. On that basis, the French version of the NACE splits the cargo handling class into two subclasses: "seaport" and "other than seaport" (road, railways, river port and airport) cargo handling. So seaport and other than seaport services of the CPA allow defining two different types of primary activity (maritime and non-maritime) for cargo handling enterprises established in France, and splitting that class into two appropriate subclasses, each being assessed by business data.

"Manufacture of prepared meals and dishes" (NACE class 10.85) is a mixed class which includes mixed businesses. Among the set of CPA products corresponding to this class, one is defined as maritime: "Prepared meals and dishes based on fish, crustaceans and mollusks". However, the French version of the NACE does not include a maritime subclass of 10.85 based on that specific CPA product.

"Collection of non-hazardous waste" (NACE class 38.11) is also a mixed class with mixed businesses: wreck breaking yards can recycle boats and other types of wrecks. The class has a set of related CPA services, including one, defined as maritime: "Vessels and other floating structures, for breaking up". Like for 10.85, no maritime/non-maritime breakdown of the class is made in the French version of the NACE, but this is no evidence that a breakdown would be unfeasible.

[7] The Statistical Classification of Products by Activity in the European Economic Community (CPA) is the official product classification of the EU. It classifies products by their physical characteristics as goods and their intrinsic nature as services by originating activity as defined by the NACE. It is the European version of the Central Product Classification (CPC) used by the United Nations. Member states may use a national classification of products by economic activity derived from the CPA.

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The above examples show that CPA can help to examine possibilities for maritime/non maritime breakdown in the national accounts on a class by class basis. A complete inventory of CPA products remains to be made for this purpose, for each EU country. An inventory would permit to identify which NACE classes can include maritime subclasses (related to CPA products identified as maritime) that be subject to separate business inquiries. At this stage of the analysis, limited to data collection (SBS), the above examples show that: a) the existence of maritime CPA products is a necessary condition to have a maritime/non-maritime breakdown of the corresponding NACE classes - except those listed in Tab.3; b) this condition is not sufficient because the approach in terms of CPA addresses case 1 above but not cases 2 and 3: mixed businesses and products cannot be subject to that breakdown - except if their maritime nature is known as primary or marginal: this refers back to case 1.

In cases 2 and 3, alternative sources are therefore necessary to get more business data. For instance, electric and telecom cables (NACE classes 27.31 and 27.32): the French cable making industry association provides a breakdown of the sector's turnover by category of cables including submarine electric and telecom cables, while the CPA does not have codes for such products. The difficulty is that turnover is the only business indicator available from that source. More generally, many alternative sources raise the problem of data quality.

A conclusion follows from the above remarks: the coverage of the maritime economy depends on the structure of the NACE and on available data, the problem being that availability is limited above a certain resolution level.

5.3. Geographical Coverage and the Inland Extent of Maritime Sectors

The geographical coverage of the maritime economy has two interlinked objectives:

- Collection of local data. Local authorities often express the need for having national reports completed by economic information on maritime regions. For instance, as mentioned in section 1, two German regions collect elements of maritime accounts. Equally, the Marnet project had the goal of reporting on Atlantic Area regions.
- Delimitation of the inland extent of maritime activities. As noted in the previous section, Pontecorvo, Wilkinson et al. (1980) included geography as demand-side criteria for identifying enterprises of the ocean sector. Later, in the EU, the study of water uses, as part of the MSFD economic and social

assessment, required defining the inland extent of coastal zones consistent with these uses.

The inland extent is essential because certain activities may have a maritime nature dependent on their vicinity to the sea. Tourism is an example: hotels, camp grounds and restaurants have a coastal nature primarily according to their distance from the shoreline. Some seaport related activities (e.g. warehouses and logistics platforms), wreck recycling yards and coastal sewage treatment facilities are also in this case. In addition, certain coastal activities (retail distribution and trade, real estate) are likely to be more impacted by maritime-specific activities if they are performed closer to the shoreline.

For these activities, it is important to define vicinity. Strictly speaking, such definition should depend on each type of activity. But in practice, it must be discussed whether a common definition to all activities is more practicable. In the former case, it would be possible to arrive at an accurate enough geographical description of sectors, but with some complexity when it comes to the local analysis of maritime businesses. In the latter case, it would be inevitable to agree on a conventional definition of the inland extent of coastal activities which cannot be perfectly fit for every economic sector.

Starting with the second option is reasonable, but the learning process could permit to switch to the first option later. Eurostat opted for the second solution and published a demographic and economic study of EU "coastal regions" (Collet 2010). They are defined as NUTS 3 units: a) with a sea border (372 regions); b) with more than half of the population within 50 km from the sea (73 regions); c) Hamburg: a German NUTS 3 unit with strong maritime features though located further inland. Based on this definition, the study provides a set of indicators including coastal population density and age structure, unemployment, employment per group of economic activities, density of accommodation capacity, and seaport passengers. A hierarchical classification based on the set of indicators is used to highlight five categories of coastal regions, in function of local population density and age, of the types of activity and of the importance of unemployment. Eurostat's approach shows that data collection at NUTS 3 level allows identifying the broad characteristics of coastal regions, using the common definition above. But while this definition seems to be relevant for population studies, its relevance should be checked for the economic study of maritime activities.

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5.4. Data Quality

The problem of statistical data quality is permanent and widespread. It is considered as a priority by the main statistical bodies, including the ESS European Statistical System[8], the United Nations, the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD). These organizations have put in place their own quality strategies (see Eurostat, 2009) and defined quality criteria. These may differ between organizations but remain largely comparable, as explained by UNECE (2010).

A European regulation (EC, 2009) establishes a legal framework for European statistics development, production and dissemination. It distinguishes "statistical principles", i.e. good practice principles, including "professional independence" and cost effectiveness; and data quality criteria properly speaking, including:

- relevance: degree to which statistics meet current and potential needs of the users;
- accuracy: closeness of estimates to the unknown true values;
- timeliness: period between the availability of information and the event it describes;
- punctuality: delay between the date of the release of the data and the target date;
- accessibility and clarity: conditions and modalities by which users can obtain, use and interpret data;
- comparability: measurement of the impact of differences in applied statistical concepts, measurement tools and procedures where statistics are compared between geographical areas, sectoral domains or over time;
- coherence: adequacy of the data to be reliably combined in different ways and for various uses.

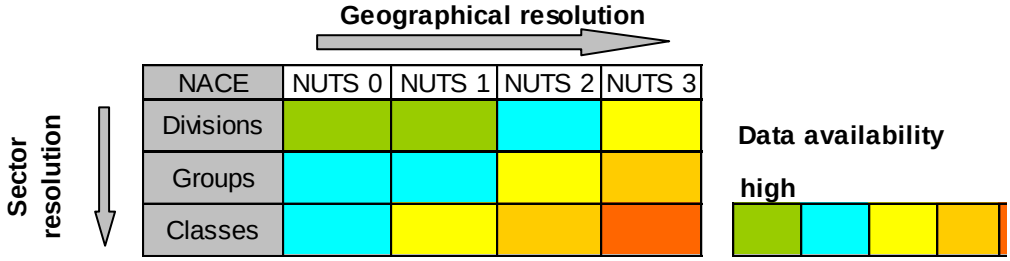
These criteria are qualitative and have not given rise to a standard quantitative assessment methodology. But they are useful in the context of maritime statistics; they permit to point out specific difficulties in cases where

[8] ESS: partnership between Eurostat, member states' NSIs (national statistical institutes) and other national statistical agencies. Partnership extends to the European Economic Area.

they cannot be met. In particular two trade-offs have been highlighted by the IMP study (Kalaydjian ed., 2009; Kalaydjian, 2014):

- The coverage vs. accuracy trade-off is related to the difficulty of having both a sufficient coverage (criterion of relevance) and accurate data. Given the lack of information on the maritime shares of partially maritime NACE classes, data users may want to get a better coverage by making estimates. There is then a risk of lower accuracy (as compared to the SBS), notably if little information is available on data sources or if these sources are one-off studies. Low accuracy may also lead to low comparability over time and regions. An alternative would be to conduct complementary business surveys. This option has its limits in terms of cost and survey overload for enterprises.
- The resolution trade-off is related to the sectoral and geographical availability of data: business data describe a sector at national level (low NUTS resolution level) regardless of the location of enterprises. For finer territorial subdivisions (i.e. at higher NUTS resolution level), the available business data are on large NACE subdivisions i.e. with a large number of sectors and businesses (i.e. low NACE resolution). Chart 6, extracted from the IMP study, illustrates the resolution trade-off in the EU. The problem is general and does not concern maritime data only, but it is compounded by the small size of the maritime economy.

Table 6. Resolution Trade-off in the IMP Database



Source: Kalaydjian (2009)

Such trade-offs can be partly dealt with: the British and French NSIs develop local economic databases at LAU2 level. They include business indicators and employment (British database) or only employment (French database): these data are not required by Eurostat and are available for sale. These local data sets can be very useful for analysing maritime activities. For

instance, using local data, the French NSI can assess employment in seaport zones by activity and location (INSEE, 2013).

5.5. Options for Coping with Limited Information

To summarize the above: the review of national and EC reports has shown that four main options exist to deal with the main difficulties mentioned above, namely partially maritime NACE classes and the need for local data on coastal zones.

Option 1 limits the scope of the maritime economy to fully maritime sectors, e.g. fisheries, aquaculture, maritime transport, ship and boat building, etc. It was adopted by Statistics New Zealand (2006) for its assessment of the country's maritime economy. Eurostat (Collet, 2013) adopted the same principle. The downside of this option is that major sectors such as coastal tourism and marine equipment, viewed as part of the maritime economy, are not reported.

Option 2, adopted in a few countries (the NOEP database and the British and French reports inter alia), estimates business indicators for the maritime subsets of partially maritime NACE classes. From an EU perspective, the major difficulty with this option is that a strict harmonisation of estimation methods would be required to get comparable data both geographically and over time.

Option 3 consists in carrying out additional surveys to supplement official business inquiries (Vega et al. 2015): legal questions of confidentiality regulation being set aside, the option is technically feasible but with risks of survey overload. Like for Option 2, harmonization of survey methods at EU level would be critical.

Option 4 consists in complementing business data with collected "proxies" related to maritime activities which are not directly reported by the SBS. As noted above (see Section 4) this option was adopted by the Marnet project. It does not permit to get a homogeneous set of business indicators for every maritime activity but is a way of collecting the primary data on the basis of which business indicators can be estimated under common rules if needed.

Each of the four options is a compromise between different constraints. Option 4 is feasible to test and can provide much basic information, as shown by the small sample of proxies included in the Marnet database. Extending the Marnet option to more EU countries would certainly be more difficult to co-ordinate and would raise the question of the reliability and comparability of proxies. Despite these difficulties this option appears to be less costly, as a first

step, than Option 3, avoids the problem of business survey overload and leaves open the possibility of Option 2; but its sustainability over time should be checked. If Option 4 is selected, given the fragmentation of the data series to collect, metadata would be required to inform on proxy sources, traceability and statistical breaks. Another major requirement would concern data quality assessment, in particular with respect to comparability and coherence of the resulting database.

6. BLUE GROWTH AND EMERGING SECTORS

A key aspect of the maritime economy was examined by the EC in the framework of the Blue Growth strategy: the analysis of emerging sectors (see section 2). The Blue Growth Strategy requires identifying and monitoring new technologies and markets in a set of sectors with high potential growth.

The question is then how emerging sectors can be analyzed using a European maritime database and whether such analysis requires an extension of the database. The answer is that more data are obviously required, and the amount of available information does not permit to get a comprehensive picture and make an accurate assessment.

The EC communication of 2012 on the Blue Growth, mentioned in section 2, described five "Blue Growth focus areas" as value chains that "could deliver sustainable growth and jobs in the blue economy":

1. blue energy, with an objective to reduce greenhouse gas emissions; this mainly includes offshore wind power, but the other marine renewables are included;
2. aquaculture, with high current growth (mainly in Asia), against a backdrop of increasing world population and increasing demand for proteins; this is an important job provider even in the EU;
3. tourism (marine, coastal and cruise), with a high growth potential linked to Europe's attractive coastlines;
4. marine mineral resources, critical for EU's growth and subject to a fast increasing world demand;
5. blue biotechnology, with high value added applications incorporating R&D, e.g. in the pharmaceuticals value chain.

The focus areas selected by the Commission were suggested by Ecorys (2012), who examined 27 "sub-functions" i.e. maritime sectors assessed in

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terms of: a) recent growth and present size according to value added and employment; and b) future potential according to several criteria, namely: innovativeness, competitiveness, job creation, policy relevance (i.e. contributing to EU policy objectives), spill-over effects and sustainability. Each maritime sector was given a rating per criterion. A list of top-7 sectors has emerged from a benchmark of the ratings (Tab.7 and 8).

The problem for the Ecorys study was to find reliable business data. For several sectors the study used proxies, for instance tonnage of transported cargo to assess the relative significance of deep sea and short sea shipping separately. The sources used by Ecorys were standard: the SBS, public European agencies (e.g. Eurosion), industry associations (European Wind Energy Association, European Cruise Council, etc.), annual business reports and a diversity of one-off consultancy studies. Value added and employment were estimated when business data were missing. The findings were fragile but had the merit of providing information on available data sources.

Table 7. Top-7 Maritime Sectors in Order of Size, Growth and Future Potential

Top-7 current size	**Top-7 recent growth**	**Top-7 future potential**
Coastal tourism	Offshore wind	Blue biotechnologies
Deep sea shipping	Cruise tourism	Offshore wind
Short sea shipping (incl. Ro- ro)	Fresh water supply, desalination	Protection against flooding and erosion
Offshore oil & gas	Short sea shipping & deep sea shipping	Marine renewable energy
Yachting and marinas	Yachting and marinas	Traceability and security of goods supply chain
Passenger ferry services	Marine aquatic products	Environment monitoring
Catching fish for human consumption	Protection against flooding and erosion	Marine minerals mining

Source: Ecorys (2012)

Table 8. Current Size of Top-7 Maritime Sectors in the EU

Sector	Gross value added (million euros)	Employment (thousand jobs)
Coastal tourism	121	2350
Deep sea shipping	98	1204
Short sea shipping	57	707
Offshore oil & gas	120	37,5
Yachting and marinas	23.4	253
Passenger ferry services	20	245
Catching fish for human consumption	8.7	220

Source: Ecorys (2012)

The recent EC call for tenders on an EU-wide maritime database (EC, 2015) also noted the lack of data for emerging sectors and the problem that "most recent studies use estimated figures for these sectors". The ToR ask for information identifying "emerging activities", including "those that are not precisely identifiable within existing classifications but that are expected to grow significantly in the long term". The ToR also ask for information on sources for every data collected. The problem of data gaps is thus identified, and an extended coverage of the database to emerging sectors would require scrutinizing every available proxy and associated data source.

7. CONCLUSION

While much knowledge has been accumulated on marine science, operational oceanography and maritime sectors over the past decades, the project of defining and assessing the maritime economy in the European Union is recent. Since the 1990s knowledge on this matter has slowly improved. After an initial phase which saw the development of national projects, cross-fertilization occurred over the past ten years between assessment methods used by member states and the European Commission; progress in EU database development was boosted by EC's policy initiatives in the maritime domain.

This knowledge improvement process made it possible to identify and discuss the main difficulties arising in developing an inter-country maritime database, notably regarding the delimitation of maritime activities and regions, and the identification of reliable indicators. This led to a general recognition that: a) the structural business statistics developed on the basis of the NACE

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was not sufficient to analyze maritime activities; b) second best solutions are necessary to collect complementary data; c) whatever the option, data quality, especially in terms of comparability and coherence is a critical condition; d) conventions are necessary to define the coverage and the geographical extent of maritime activities; they are a compromise between the need for including diversity of the maritime sector and the need for having a common method at EU level.

Limited information on the maritime subsets of a number of NACE classes requires sharing experience and information on difficulties in collecting data and ensuring comparability on a European scale. Sharing information requires in turn developing comprehensive metadata to provide detailed information on the nature and sources of the indicators collected. Agreeing on a standardization of metadata would be the only way to improve data comparability, and the approach adopted by the Marnet project was a step in this direction. With the recent call for tenders for the development of an EU-wide maritime database, EC's approach to metadata has become more demanding.

Comprehensive metadata would permit to use comparable proxies and better inform partially maritime NACE classes with the purpose of assessing their maritime shares. It would also help to consider extending the database using other types of proxies, e.g. related to the environmental footprint of maritime activities. This specific topic will take up an increasing importance in the years to come with the impacts of climate change on coastal zones, and is likely to require discussing further development in terms of nature and objectives of an EU maritime database.

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