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Challenges in measuring indicators of progress for the Atlantic Action Plan

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1. INTRODUCTION

The EU Atlantic Area region supports 20% of the EU's blue economy measured in terms of employment and gross value added (GVA) (EC, 2021). Recently a new revision of the Atlantic Action Plan (AAP) (EC, 2013), termed Atlantic Action Plan 2.0 (AAP 2.0), was released. It is therefore timely to examine the challenges in measuring the progress of the previous AAP and what lessons may be learnt for the implementation of the revised AAP 2.0 and more broadly for implementation of policies in regional maritime economies (EC, 2020a). The AAP was adopted in 2013 with the aim of supporting the growth of the 'blue economy' of EU Member States in the Atlantic Ocean area[1] (EC, 2018).

Despite the allocation of four priorities in the plan, subdivided into objectives, there were no specific indicators developed to monitor progress in achievement of the aims of the AAP. This lack of indicators coupled with the absence of a monitoring framework for evaluating the performance of the action plan was highlighted as a weakness of the AAP in a mid-term review (EC, 2018). The report noted some successes of the AAP, identifying 1,200 projects, consisting of circa €6 billion of investment over 4 years that had benefited from the AAP support. The same report also found weaknesses including the fact that the wide-ranging scope of the plan reduced its ability to drive policy change and the implementation of the plan was seen to be hampered by a weak governance structure. One of the recommendations of the review was to improve monitoring of the AAP and this recommendation has been incorporated into the AAP 2.0.

While the inclusion of better indicators, baselines and targets[2] are evident in the AAP 2.0 (EC, 2020a), there are some issues with certain indicators. One example is short sea shipping[3] where the baseline figure in the plan is based on the aggregated short sea shipping trade between ports in the EU Atlantic Area of the five member states but there are still some differences in how the boundaries of the EU Atlantic Area are defined between different EU bodies[4]. In contrast another indicator's baseline, installed marine renewables capacity, is based on the aggregated install capacity across all five of the EU Atlantic Area member states irrespective of the sea basin, thus inflating the current baseline as it includes installed capacity in the North Sea. How indicators and baselines are constructed are important considerations in order to determine if the AAP 2.0 meets its targets overall. Such indicators are also

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[1] Ireland, the United Kingdom, France, Spain and Portugal. Note that the United Kingdom has left the EU since 2020 (EC, 2019) known as Brexit.

[2] AAP 2.0 indicators, baselines and targets are shown in Appendix A.

[3] Short sea shipping is the maritime transport of goods over relatively short distances, as opposed to the intercontinental cross-ocean deep sea shipping.

[4] See Appendix B for maps showing different boundary definitions of the EU Atlantic Area for Interreg Atlantic Area and Eurostat, two bodies of the EU.

useful for interested stakeholders at both EU and regional level to understand how each region is contributing to meeting these targets. This paper uses a regional ocean economy data framework developed under the EU MOSES project, to generate a series of four indicators which should be useful for monitoring progress of the AAP 2.0 (EC, 2020a).

The initial AAP (EC, 2013) was a plan to enact the Atlantic Strategy (EC, 2011) which was adopted in 2011. The Atlantic Strategy was driven in part by elements of the Barroso Commission's 10-year vision known as Europe 2020 (EC, 2010) which was focused on smart, sustainable and inclusive growth and the implementation of the Integrated Maritime Policy for the EU (EC, 2007). The AAP complemented other Strategies that had already been adopted for the Baltic Sea, the Arctic Ocean and the Mediterranean Sea.

The EC's communication on the Maritime Strategy for the EU Atlantic Area (EC, 2011) points out the challenges and opportunities facing the EU Atlantic Area. These are categorized into five topics designed to be in harmony with the requirements of the EU Marine Strategy Framework Directive (MSFD, 2008/56/EC):

- Implementing an ecosystem approach for the management and monitoring of a set of activities including fisheries, aquaculture, spatial planning and ocean observation;
- Reducing Europe's carbon footprint by developing marine energies; co-operating with IMO to reduce carbon emissions from waterborne transport; shifting from road to sea transport by developing short sea shipping;
- Sustainable exploitation of the mineral and biological resources of the seafloor;
- Responding to threats and emergencies from natural or man-made accidents and criminal activities;
- Socially inclusive growth, by promoting training, regional clustering of maritime industries and discerning tourism.

The AAP therefore built on the EC's communication on the Maritime Strategy for the EU Atlantic Area. The AAP had no dedicated funding but was to instead act as guide to leverage other funding, offer support and reinforce collaboration to achieve its aims; targeted investment, increasing research capacity and the attainment of higher skills in maritime sector employment in the EU Atlantic Region. Based on the Atlantic Strategy, four "priorities" were identified to shape the AAP, each being subdivided into ten "specific objectives".

Priority 1: promote entrepreneurship and innovation. This includes the two specific objectives of "knowledge sharing" in terms of research and technology, and "competitiveness enhancement" in the maritime economy in terms of improving skills through education and awareness. The AAP recognises that a skilled workforce is a necessary condition for the blue economy to reach its potential. A third specific objective was aimed at fisheries management and aquaculture competitiveness as these industries raise the major issue of combining innovation and modernization objectives with sustainable resource exploitation.

Priority 2: protect, secure and develop the potential of the Atlantic marine and coastal environment. This includes a set of far reaching and complex objectives, namely:

safety and security, in line with topic 4 of the Atlantic Strategy, regarding seafarers, coastal populations and adapted technologies;

protection of marine waters and coastal zones through ocean observing systems, climate change impact mitigation and efforts toward achieving MSFD objectives;

management of marine resources, in line with topic 3 of the Strategy;

enhancement of marine energy projects.

Priority 3: improve accessibility and connectivity. Its specific objective aims at logistics connectivity, in terms of hinterland connections, multi-modal connectivity, shore side energy supply, and development of port network and short sea shipping.

Priority 4: create a socially inclusive and sustainable model of regional development. This includes two objectives intended for local populations and related to health, social inclusion and coastal activity diversification.

The AAP 2.0 (EC, 2020a) was developed in response to the weaknesses found in the AAP over the period 2014-2019, particularly during the mid-term review in 2018. These weaknesses related to governance, monitoring and evaluation, plan coherence and communication. In terms of improved governance, political coordination of AAP 2.0 will be by EU Atlantic Area countries' designated ministers responsible for maritime affairs while operational coordination will be undertaken by the Atlantic Strategy Committee. In terms of funding, similar to AAP, there was no explicit funding earmarked from the EU budget, instead the plan will rely on private and public funding from national and existing EU funding programmes. The AAP 2.0 was also released at a time of major policy change and challenges in the EU, including the Covid-19 crisis, Brexit and the new requirements of the European Green Deal (EC, 2019), the latter aiming to allow the EU recover on a more sustainable pathway after the Covid-19 crises and to have the EU carbon-neutral by 2050.

There has also been a change in the plan structure from APP to APP 2.0. Now there are four "pillars" subdivided into seven "goals". These are:

- Pillar 1: Ports as Gateways and Hubs for the Blue Economy
    - Goal 1: Ports as gateways for trade in the Atlantic Actions
    - Goal 2: Ports as catalysts for business
- Pillar 2: Blue Skills of the Future and Ocean Literacy

    - Goal 3: Quality education, training and life-long learning
    - Goal 4: Ocean literacy
- Pillar 3: Marine Renewable Energy
    - Goal 5: The promotion of carbon neutrality through marine renewable energy
- Pillar 4: A Healthy Ocean and Resilient Coasts
    - Goal 6: Stronger coastal resilience
    - Goal 7: The fight against marine pollution

It is hoped that these pillars will focus efforts and achieve more progress than the original AAP. To monitor progress for the AAP 2.0, a monitoring framework was proposed (EC, 2020b) which has ten proposed indicators, seven of which are quantitative and the remaining three qualitative. Six of the quantitative indicators have baselines and targets included in their measurement. These are shown in Appendix A.

Monitoring the progress towards achieving the aims or goals of policies or plans is not a new concept and is not particular to plans related to maritime economies. The struggle to create, find, or adapt indicators for use in monitoring plans and policies has been noted across many policy areas, in a variety of institutions and at different scales. Hoekstra *et al.* (2017) showed the difficulties in accurately quantifying water consumption and pollution in crop production in practice. These were indicators needed to measure progress towards UN Sustainable Development Goal 6 that is focused on water use. Elsewhere, Han *et al.* (2014) demonstrated efforts to monitor progress towards the global Aichi biodiversity targets by overcoming the lack of baseline biodiversity data. Roberts and Moritz (2011) point out that where such data is available it is often disaggregated, heterogeneous, and non-standardized and therefore not suitable for comparison across time or between countries or regions. Even across the EU which has similar institutional structures, issues have arisen in developing suitable indicators for measuring climate change policies (Schoenefeld *et al.*, 2018) and the circular economy (Helander *et al.*, 2019).

Within the marine sphere the difficulties of finding suitable indicators for monitoring progress is also found in relation to biodiversity (Ware and Downie, 2020) and in monitoring marine socio-economic developments (Hynes and Farrelly, 2012, Foley *et al.*, 2014). Fernandez-Macho (2016) identified what he called “failed indicators” for measuring statistical coverage of European Atlantic maritime economic sectors. These “failed indicators” arise from a lack of data on a particular economic sector or for a particular sector at a certain scale. This prohibits any comparative analysis between countries or regions or across economic sectors. One approach to overcome these issues, a data collection framework known as MARNET (Foley *et al.*, 2014) was created for the EU Atlantic Area region. This data framework and associated database was developed to collate comparable marine socio-economic data across the Atlantic EU member states regions and covered the period 2009-2012.

More recently, EU DG Marine Affairs have been producing annual EU Blue Growth reports that monitor economic progress across a range of marine industries in the EU, by member state (European Commission, 2021).

This paper uses data from an updated version of the MARNET data collection framework developed under the EU MOSES project that extends the data forward in time. MOSES developed a suite of marine economic indicators where the NUTS3 region was the regional unit of analysis[5]. While MOSES was focused on economic data, it also collected non-economic data to supplement the economic data. This paper highlights how four of the non-economic indicators could be used to help in measuring the progress of the AAP 2.0 (EC, 2020a). These are shown in Table 1 and where there are AAP 2.0 baselines and targets[6], these are included.

Table 1. The indicators from the MOSES framework suggested for use in monitoring the AAP 2.0 (EC, 2020a).

Indicators	Currently included in AAP 2.0 monitoring framework	Current baseline in AAP 2.0.	Current target in AAP 2.0.
Short sea shipping tonnage	Yes	261,021 kilotonnes (2016)	>0% growth per year
Marine renewables capacity	Yes	7,230 MW (2017)	Increased installed capacity in the EU Atlantic area
Commercial bed nights	No	-	-
Index of anthropogenic vulnerability	No	-	-

[5] Nomenclature of Territorial Units for Statistics (NUTS) is the acronym of the EU system established by Eurostat in order to provide a single uniform breakdown of territorial units for the production of regional statistics for the European Union. NUTS level 0 is used to define EU member states with NUTS levels 1,2 and 3 used to define increasingly smaller regional definitions with level 3 the smallest NUTS territorial definition. Subnational changes are only allowed every three years.

[6] AAP 2.0 indicators, baselines and targets are shown in Appendix A.

Two of the indicators are already used to assess progress across both the AAP and AAP 2.0, namely those associated with short sea shipping (Priority 2 in AAP and Pillar 1 in AAP 2.0) and marine renewables (Priority 2 in AAP and Pillar 3 in AAP 2.0).

A third indicator, commercial bed nights is also suggested for use as a possible future AAP 2.0 indicator. The reason for suggesting its inclusion is that coastal and maritime tourism is the largest sector of the EU Atlantic Blue Economy (EC, 2020a, EC 2021) and the European Commission has highlighted that many coastal and island regions have suffered disproportionately from the impact of the Covid-19 crisis due to their reliance on this sector (EC, 2020). Additionally, under goal 6 of the AAP 2.0 one of the actions is to "Promote sustainable practices in coastal and maritime tourism". Inclusion of a commercial bed nights indicator at local or regional level could help monitor regions under pressure or act to focus funding and research.

Finally, other non-monetary data collected by MOSES was used to construct an index of anthropogenic vulnerability measuring the impact of human uses on the EU Atlantic Area coastal regions. This included data on marine spills, energy efficiency, tourism and recreation, area of coastal Sites of Community Importance, and water quality and waste management. Data Envelopment Analysis (DEA) was used to construct the synthetic index of vulnerability ranking EU Atlantic Area countries at the NUTS3 level (Fernández-Macho *et al.*, 2020). The inclusion of this indicator is suggested to assist in monitoring Pillar IV of AAP 2.0: Healthy Ocean and Resilient Coasts.

This paper focuses on the challenges of identifying suitable indicators for the monitoring of the AAP and explores how this could be done in practice using some of the data collected in MOSES. This paper is not meant to be an exhaustive review of the success or otherwise of the AAP but rather attempts to highlight how some of the data collected in the MOSES project might be used to monitor progress made. In what follows, section 2 provides an overview of the MOSES data collection methodology and how it was extended in this paper to generate the AAP and AAP 2.0 indicators. Section 3 presents the results and shows the change over time and spatial distribution of the indicators while section 4 discusses the results and offers some final conclusions.

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2. METHODOLOGY

The primary source of data used in this paper was collected within the MOSES project. The main elements of the database are:

Marine activities are identified by NACE code[7]. This hierarchical classification is exhaustive (all activities are classified by NACE class, with one code per class). This avoids double counting (each activity has one code) and allows for readily accessible economic documentation by activity.

Marine activities are equally identified by territorial unit, based on the NUTS European statistical classification of territorial units. The units used in the database include countries (level 0 of the NUTS) and EU Atlantic regions (levels 2 and 3), i.e., units with an Atlantic shoreline. Level 1 is less necessary as it includes countries or groups of regions.

Collecting reliable data requires using official European sources whenever possible: the MOSES project gave priority to the databases from Eurostat and the National Statistical Institutes of the five Atlantic EU member states countries. The EC statistical administration, Eurostat, collects data from the National Statistical Institutes under EU regulation. The coverage of Eurostat's databases evolves over time and may cover new areas depending on the needs of the EU, with the permanent objective of having comparable data across EU countries and regions.

Economic indicators are selected among those currently used by these sources for developing the Structural Business Statistics and National Accounts. Such indicators are available at NUTS 0 only. At higher NUTS levels (regions and sub-regions), only establishments can be documented with much fewer indicators, e.g. number of establishments and employment.

Specific "proxies" are collected to supplement economic indicators and are mostly available at regional or local level: proxies are non-monetary indicators characterizing important features of certain marine activities.

The time frame of the MOSES database (2013-2015) follows on from that of MARNET (2005-2012).

While the purpose of the MARNET project was to focus on developing a detailed description of marine activities' including their economic and social characteristics, and their territorial extension, the MOSES project gives priority to sustainability issues for the main components of the marine economy. Like MARNET, one of the

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[7] Nomenclature statistique des activités économiques dans la Communauté européenne (NACE) is the acronym of the EU system used to designate the various statistical classifications of economic activities and is derived from the United Nations' International Standard Industrial Classification of all Economic Activities (ISIC)

issues faced by MOSES was setting the boundaries of the EU Atlantic Area, as a number of differing definitions have been made by EU bodies (See Appendix B). This was further complicated by the fact that the EU periodically updates its NUTS boundaries within member states. During the period under review boundary changes did not occur, but it is a factor that needs to be considered in developing time series using NUTS at subnational level.

Unlike MARNET, the finest levels of the NUTS, namely LAU1 and LAU2 (Local Administrative Units), have not been included. Another major simplification concerns population data. This was an important dimension of the MARNET database but was not collected in the MOSES database. Such population data may have been useful for monitoring Priority 4 of the AAP to document coastal areas in terms of occupations of the population both in terms of employment (where economic activities are located) and residence (where the population lives).

Marine renewables production is sufficiently covered by the MOSES database to be useful as an indicator for Priority 2 for the AAP. In terms of short sea shipping indicator (Sea and coastal freight water transport – NACE code H50.20), which is an indicator for Priority 3 of AAP, the MOSES database is limited to the assessment of port turnover at national level and traffic at NUTS3 level. To improve the coverage, more indicators would be required with a higher resolution both at activity (energy supply, inland-bound cargo flows, amount of exchange flows between Atlantic ports) and territorial (port areas) levels. To extend the short sea shipping dataset, EU Atlantic Area member state port data from Eurostat dataset mar_go_am_detl was aggregated to NUTS3 level which allowed extension of the MOSES dataset to 2019.

For the marine renewable energy indicator (Production of electricity – NACE code D35.11) MOSES partners were asked to update details of marine renewable energy installations to 2018. As there are no EU administrative regions in the marine space below member state Exclusive Economic Zones (EEZs), activities in the marine space (e.g., offshore windfarms) were allocated to the nearest NUTS3 territorial unit through the development of NUTS3 marine regions (Figure 1[8]). This was achieved by using a geographical information system (GIS) to project the NUTS3 2016 (terrestrial) regions in the European grid, based on ETRS89 Lambert Azimuthal Equal-Area projection coordinate system (EPSG:3035). This allows measurement in metres, rather than degrees and it is the official European projection system widely used for Pan-European GIS analysis according to the EEA (2017). The median lines were then calculated using Thiessen polygons between NUTS3 regions within each Member State’s EEZ. This approach follows that prescribed by a similar methodology used by Marineregions.org (2019).

The commercial bed nights indicator is employed here as a proxy for tourism pressure. Although there are other metrics that could be used for measuring tourism,

[8] Note that these NUTS3 marine regions were constructed purely for the purposes of allocating human activities within marine regions and not indicative of support for any maritime claims.

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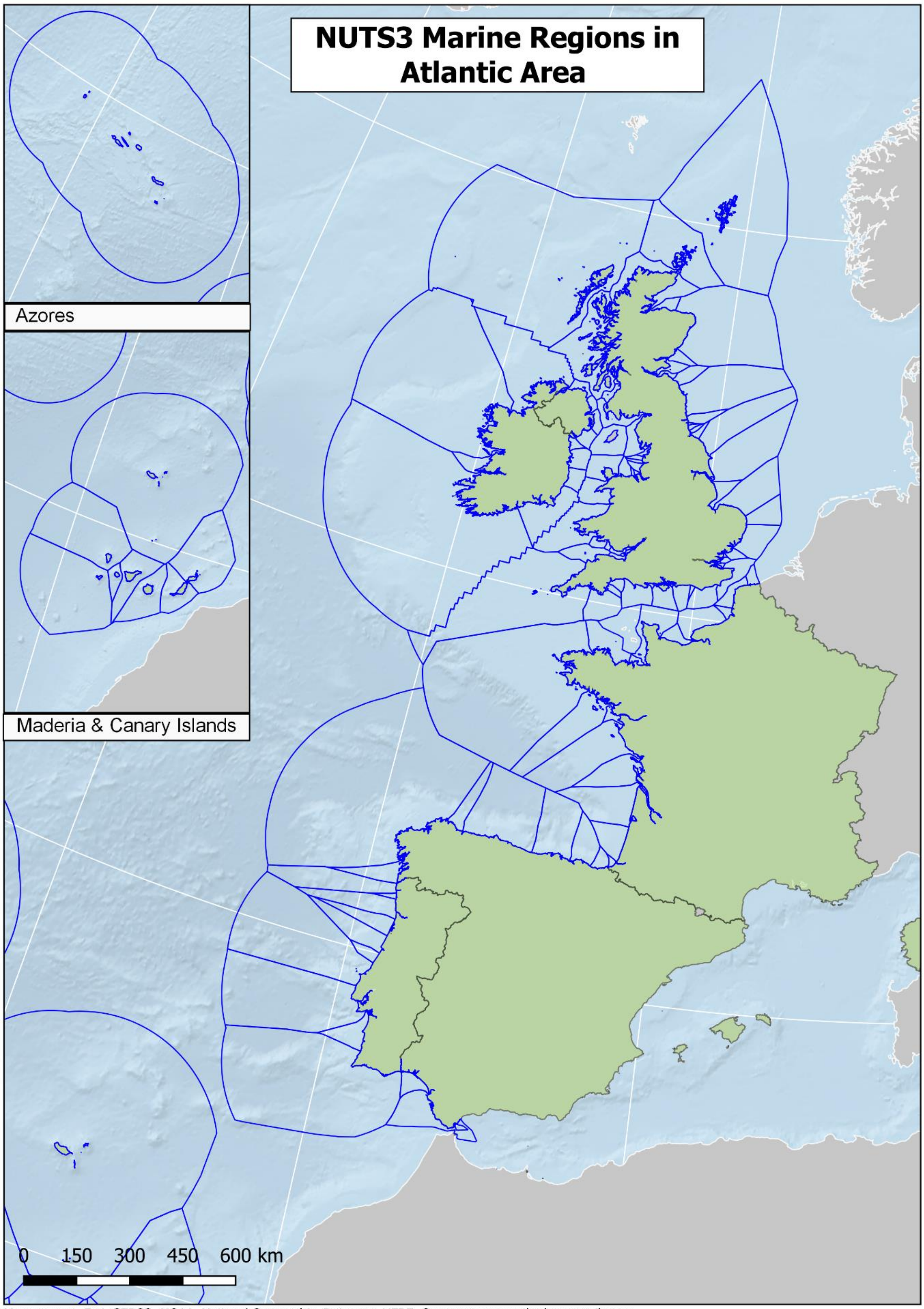
commercial bed nights was the tourism proxy indicator with the best coverage both spatially and temporally. It can be defined as the aggregated number of nights spent by tourists in hotel and similar serviced accommodation. It excludes non-serviced accommodation and camping bed nights. It has the benefit of avoiding double counting in comparison to trip numbers. Trip numbers per region may double count if different countries and regions are visited in the same trip. Given that the monitoring framework used in the AAP 2.0 is still a suggested framework, the inclusion of this indictor here is to show how the data could be used as a possible future indicator for the AAP 2.0.



Map sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org and other contributers.
Data source: MOSES project (http://mosesproject.eu/)

Figure 1. Outlines of NUTS3 marine regions shown outlined in blue.

For commercial bed nights (Hotel and serviced accommodation - NACE code I55.10), the MOSES dataset was limited to national level data in terms of full temporal coverage and MOSES partners updated their earlier estimates to cover the period up to 2019. Subnational level analysis with complete coverage was only available for one year, 2015, and it is noted that UK data was reported at NUTS2 level rather than NUTS3 level. Collection of tourism data was quite a difficult process as in some country's tourism data is collected by subnational bodies (UK – Scotland, England & Wales, Northern Ireland) or in others it is carried out by a separate body to the national statistics institute (Republic of Ireland).

MOSES also assessed the levels of coastal vulnerability in the EU Atlantic Area. This was achieved by constructing a synthetic index which was used to rank the EU Atlantic Area countries and regions at NUTS3 Eurostat geographical level. Coastal vulnerability was defined as 'the degree to which coastal areas are susceptible to damage or degradation due to environmental conditions and impacts related to maritime transportation, port facilities and coastal socio-economic uses'. There were five vectors of pressures considered. These were marine spill risk; port facilities impact; coastal activities and tourism; protection of coastal areas; and bathing water quality. In order to estimate the size of these pressure vectors, data collection was undertaken using an extensive number of sources including Eurostat, EcoPorts, regional agencies, EU Directives, and previous research in the area of each vector. For a full elaboration on the development of the index see Fernández-Macho *et al.* (2020). This measure of the level of human impacts on marine waters and coasts is particularly useful for monitoring progress under Priority 2 of the AAP where one of the aims is the protection of marine waters and coastal zones through ocean observing systems, climate change impact mitigation and efforts toward achieving MSFD objectives and under pillar 4 of the AAP 2.0.

3. RESULTS

3. 1 Short sea shipping indicator

One of the indicators for measuring the impact of the AAP and AAP 2.0 is the change in short sea shipping. Short sea shipping is the maritime transport of goods over relatively short distances in for example a sea basin (EC, 1999). From the MOSES data, the figures produced are for shipping between EU Atlantic Area NUTS3 regions of Ireland, UK, France (Atlantic Coast), Spain (including the Canaries) and

Portugal[9](including the Azores & Madeira). Figure 2 shows the change in Eurostat estimates of short sea shipping for the various EU sea basins. Note that the EU Atlantic Area, as measured by Eurostat, has a relatively small level of short sea shipping compared to the EU's other maritime regions comprising only 12.3% of the EU's short sea shipping in 2019 (Eurostat, 2021).

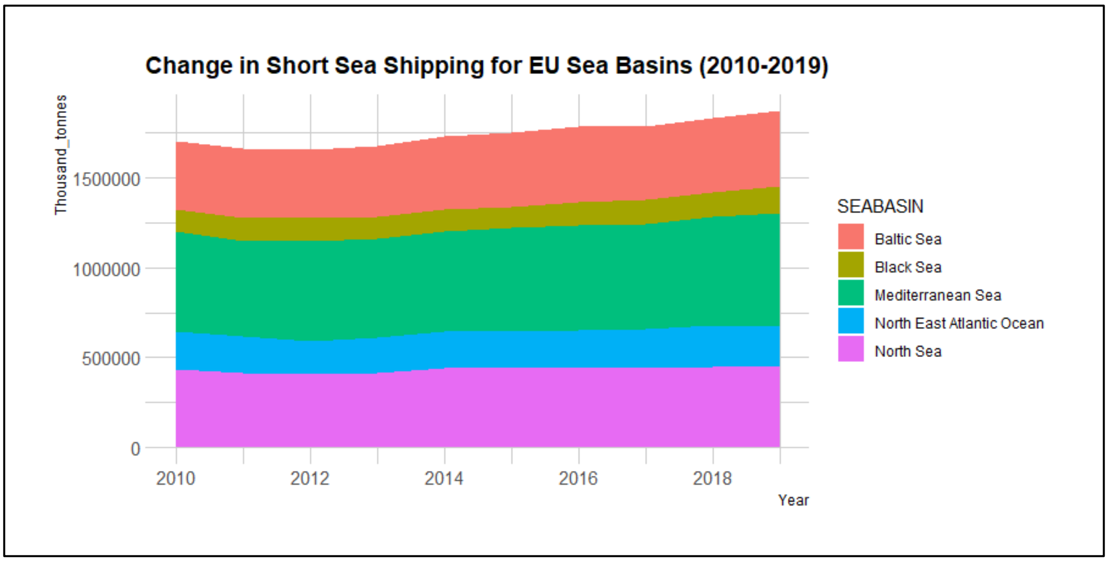


Figure 2. Short sea shipping for EU sea basins as measured by Eurostat.

Figure 3 shows the MOSES estimate for EU Atlantic Area short sea shipping in the period 2010-2019. It shows that prior to the Atlantic Action Plan in 2013 that there was a drop in levels of short sea shipping in the EU Atlantic Area from 274 million tonnes in 2011 to 239 million tonnes in 2013, a decrease of 12.8% over 2 years. However, it quickly rebounded to 267 million tonnes in 2014 and from 2014 to 2019 saw an increase of 4.3%

[9] See Appendix B for differences between MOSES estimates and Eurostat estimates of short sea shipping.

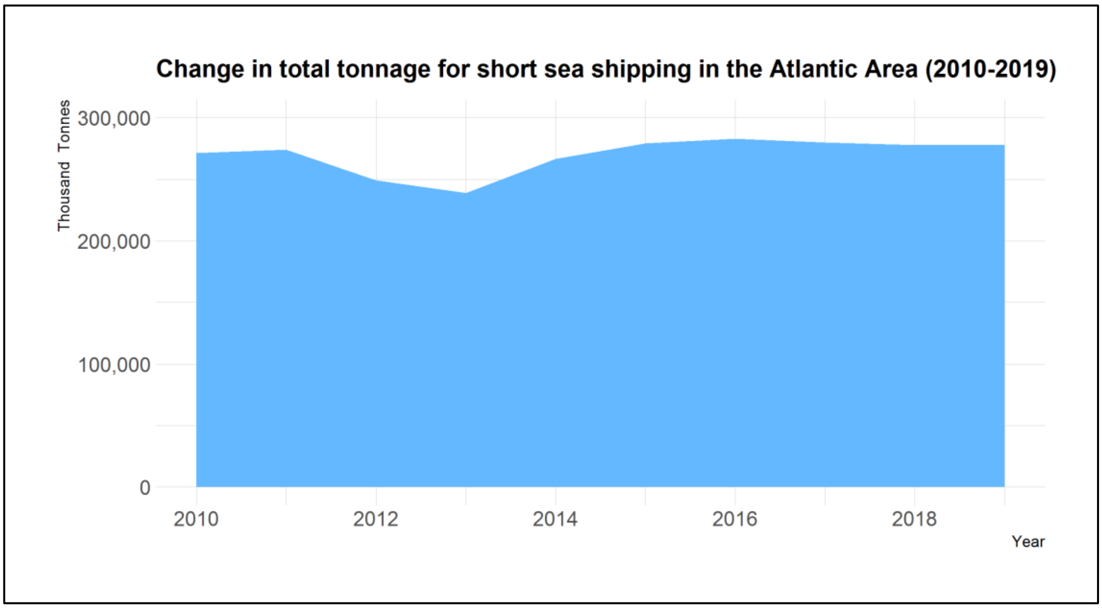


Figure 3. Change in total tonnage for short sea shipping in the Atlantic Area (2010-2019) (MOSES estimate)

It may be more useful to breakdown the aggregate figures shown above and see the trends in short sea shipping broken down by types of cargo. Figure 4 shows this breakdown and the large decrease from 2011 to 2013. When seen through the cargo lenses, the drop would appear to be driven by a fall in the short sea shipping of bulk goods, both liquid and dry. The fall in liquid bulk had not recovered by 2019 and may be a reflection of a longer term move towards renewable energy, sustainable transport and a more energy efficient economy as a significant portion of the liquid bulk cargo is in the form of fossil fuels including oil (crude and refined) and liquefied natural gas. Most of the rise since 2014 has been driven by growth in dry bulk and container transport (both Ro-Ro and Large Containers) although the period 2016 to 2019 has seen a decrease of 8.7% in one the largest cargo types in EU Atlantic Area short sea shipping; Ro-Ro (Mobile self-propelled units).

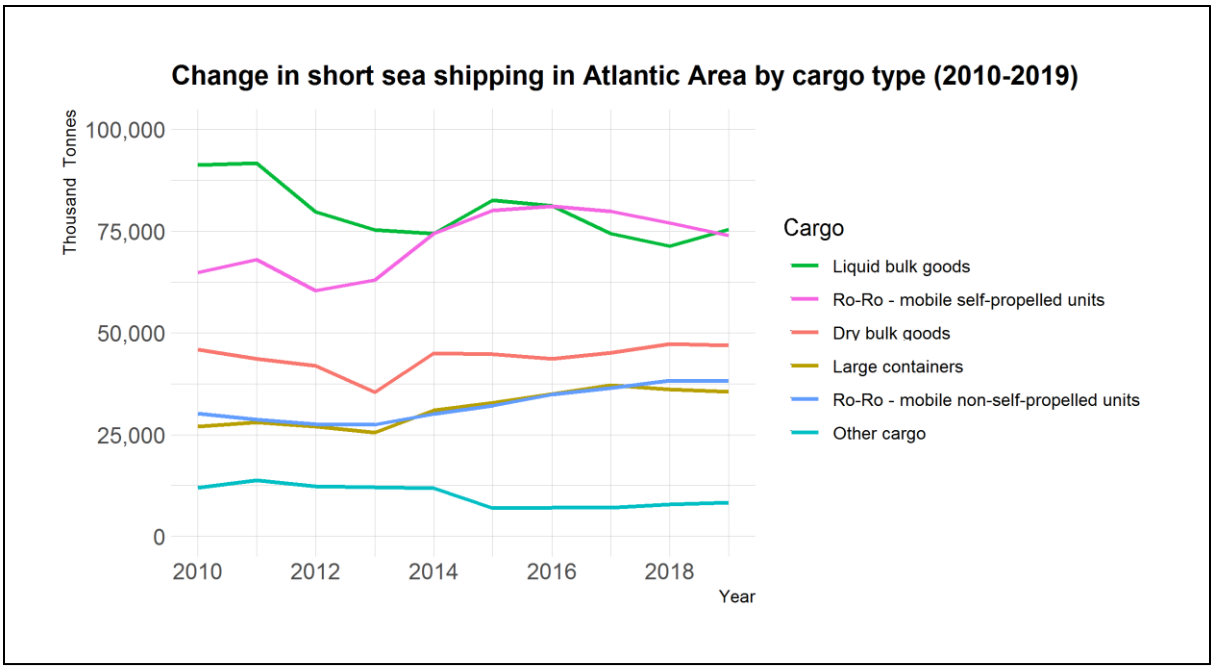


Figure 4. MOSES estimates for the EU Atlantic Area region of short sea shipping broken down by cargo type (2010-2019).

An alternative to breaking down changes in growth by cargo types, is to examine the spatial distribution of changes in short sea shipping in the EU Atlantic Area. Aggregating port data to NUTS3 regions, gives some idea of the regional impact of ports. In Figure 5, while most regions show little change or some slight growth, there are some areas highlighted which show significant change. High growth in short sea shipping is seen in Spain in the regions of the Canaries and Southern Spain, in addition to Asturias and also in ports bordering the Irish Sea. Brittany is the lone growth highlight along the French coast, with many regions seeing a decrease in short sea shipping.

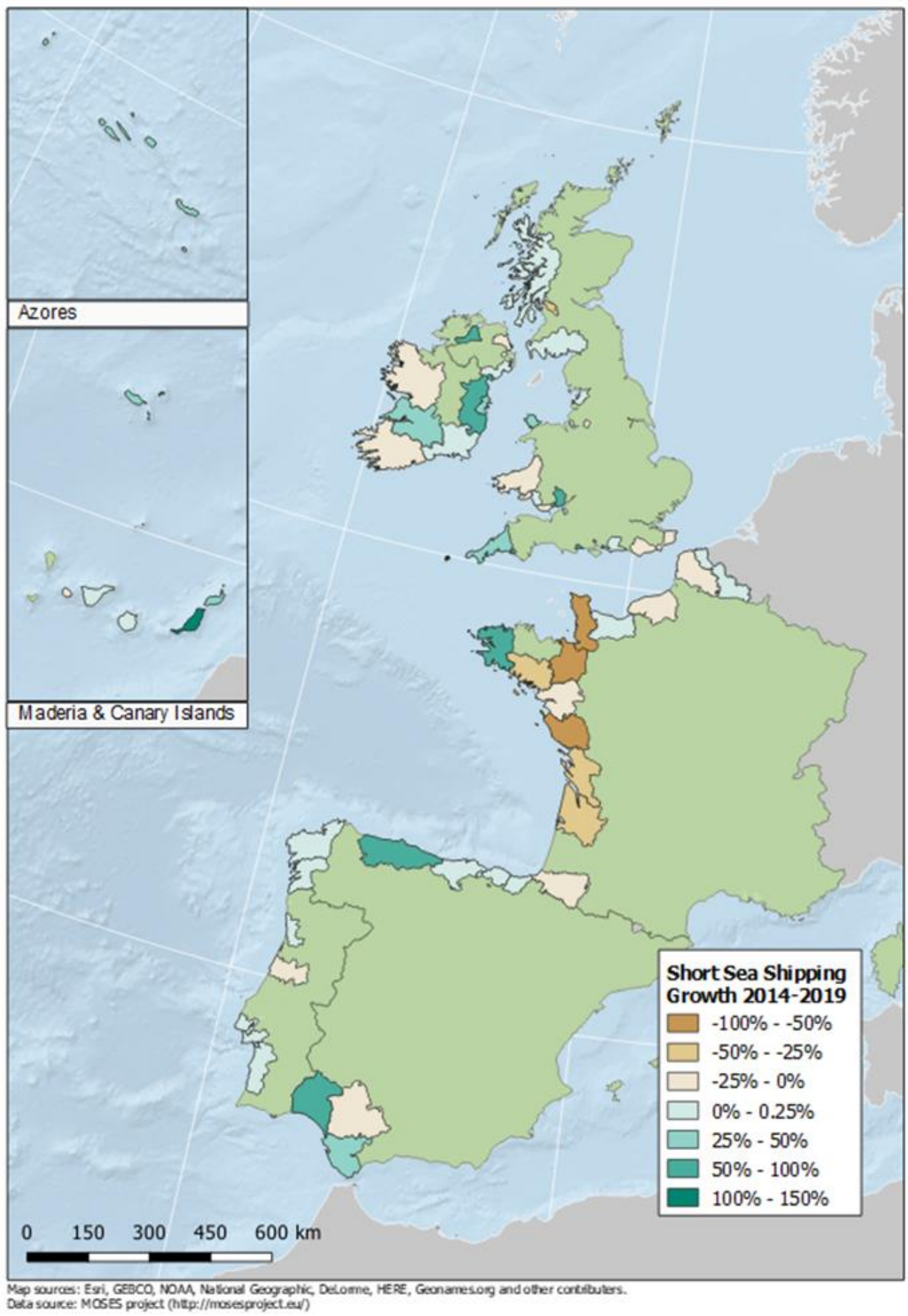


Figure 5. Short sea shipping growth at NUTS 3 level across the EU Atlantic Area 2014-2019.

Another feature of the extended MOSES dataset for shipping is that the trading partners for EU Atlantic Area ports is broken down at national level and in some cases at a regional level[10]. This allows one to estimate the dependency of each region and/or port on short sea shipping. Figure 6 shows that the value of examining this data spatially is that regions that are most dependent on short sea shipping can be identified and when visualised in this manner, three areas stand out for their dependence on EU Atlantic Area short sea shipping. The outermost islands of the Canaries, Azores and Madeira have high dependency rates (in excess of 80%) and this can also be seen in other relatively remote regions like Western Scotland, Cumbria in the UK and the West region in Ireland. Ireland generally has high levels of dependence on EU Atlantic Area short sea shipping due to the use of the UK as a 'land bridge' (Vega *et al.*, 2021). This land bridge extension across the English Channel can also be seen in the map from the high reliance of Dover and Calais regions on short sea shipping. Brexit will have had a major effect on short sea shipping in this region and the 2021 data may show the emergence of new EU Atlantic Area short sea shipping routes. This is acknowledged in the AAP 2.0 where one of the actions under goal 1 aims to "Foster short-sea shipping links in the EU Atlantic Area to better integrate Ireland".

[10] See Appendix C for more details on this breakdown.

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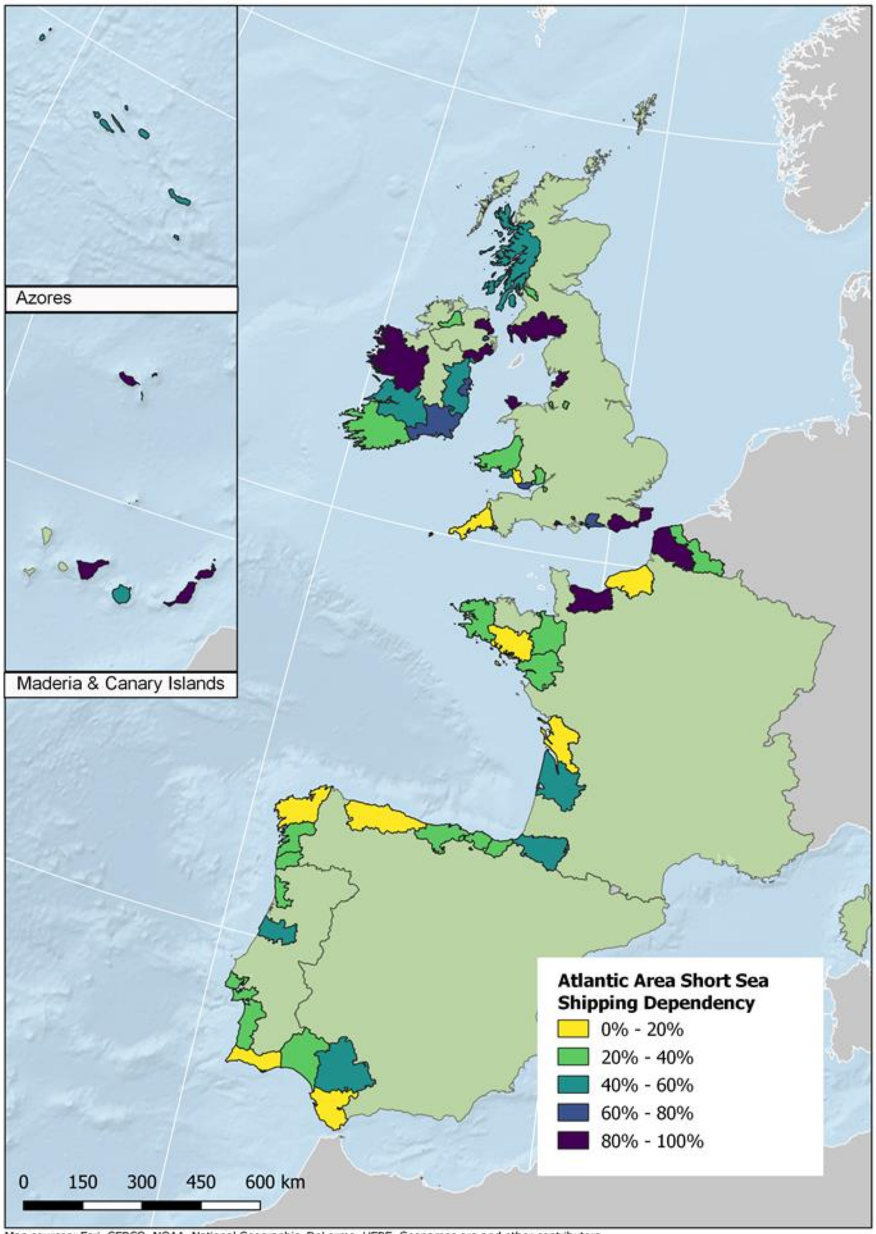


Map sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org and other contributers.
Data source: MOSES project (http://mosesproject.eu/)

Figure 6. EU Atlantic Area short sea shipping dependency.

3.2. Installed marine renewables indicator.

The North East Atlantic Ocean region has some of the world's greatest potential for marine renewable energy across wave, tidal and offshore wind. The latter of these has seen the most development in recent years, piggybacking off earlier research and development into land based wind technology. This can be seen in the breakdown of different marine renewable generation types with the offshore wind energy sector dominating both the amount and growth of the installed marine renewable capacity in the EU Atlantic Area member states as shown below. Since the implementation of the AAP in 2014, which aimed to accelerate the deployment of sustainable offshore renewable energy, there has been a growth of nearly 87% in installed marine renewable capacity in EU Atlantic Area member states.

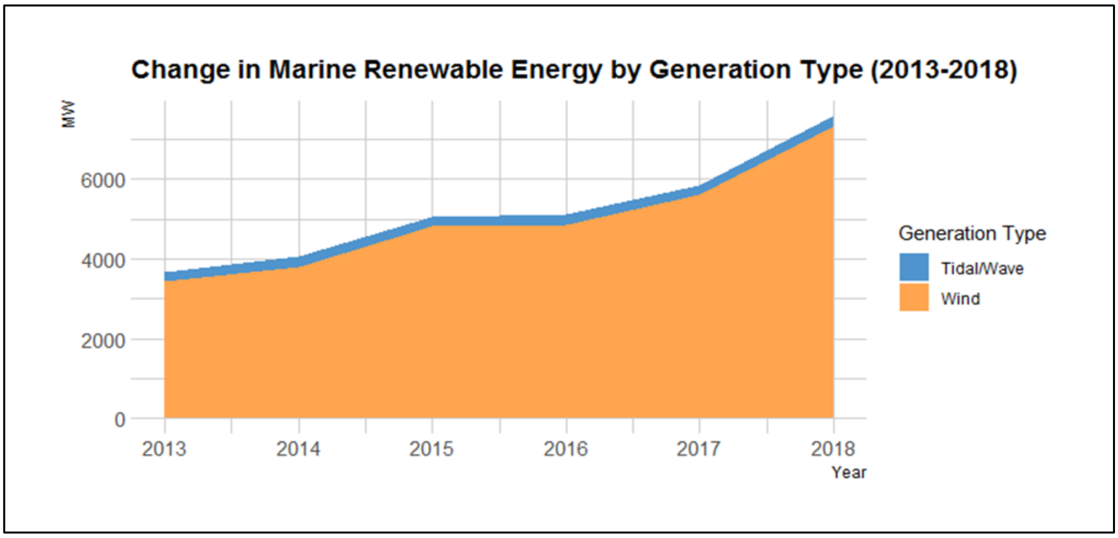


Figure 7. Change in marine renewable energy in EU Atlantic Area member states by generation type.

However, the rollout in renewable energy has not been equally distributed across EU Atlantic Area member states. Instead, one, now former, member state, the United Kingdom has dominated the growth in offshore renewable energy as shown in Figure 8. Due to Brexit, the AAP 2.0 baseline in 2017 of 7,230 MW of marine renewable energy capacity in the EU Atlantic Area will need to be lowered to circa 270 MW.

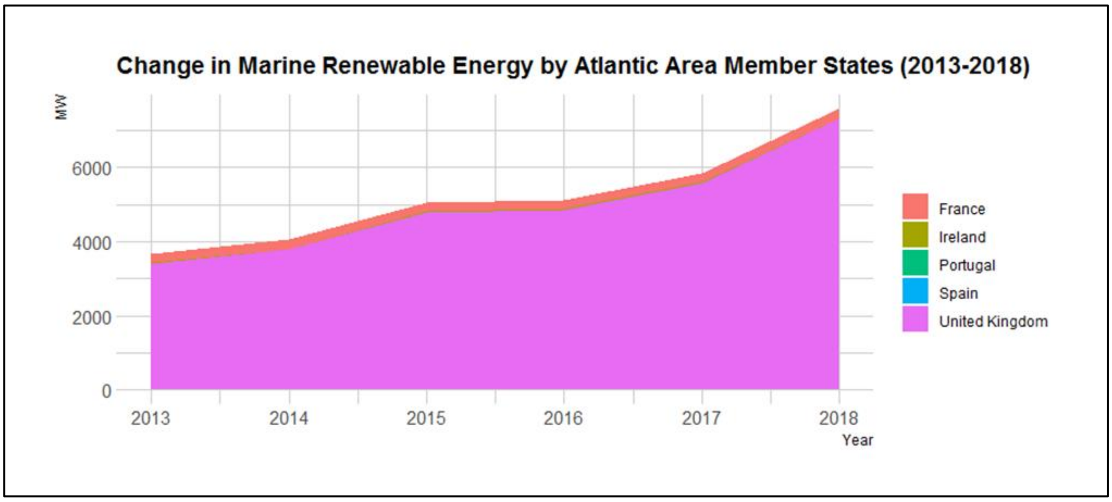
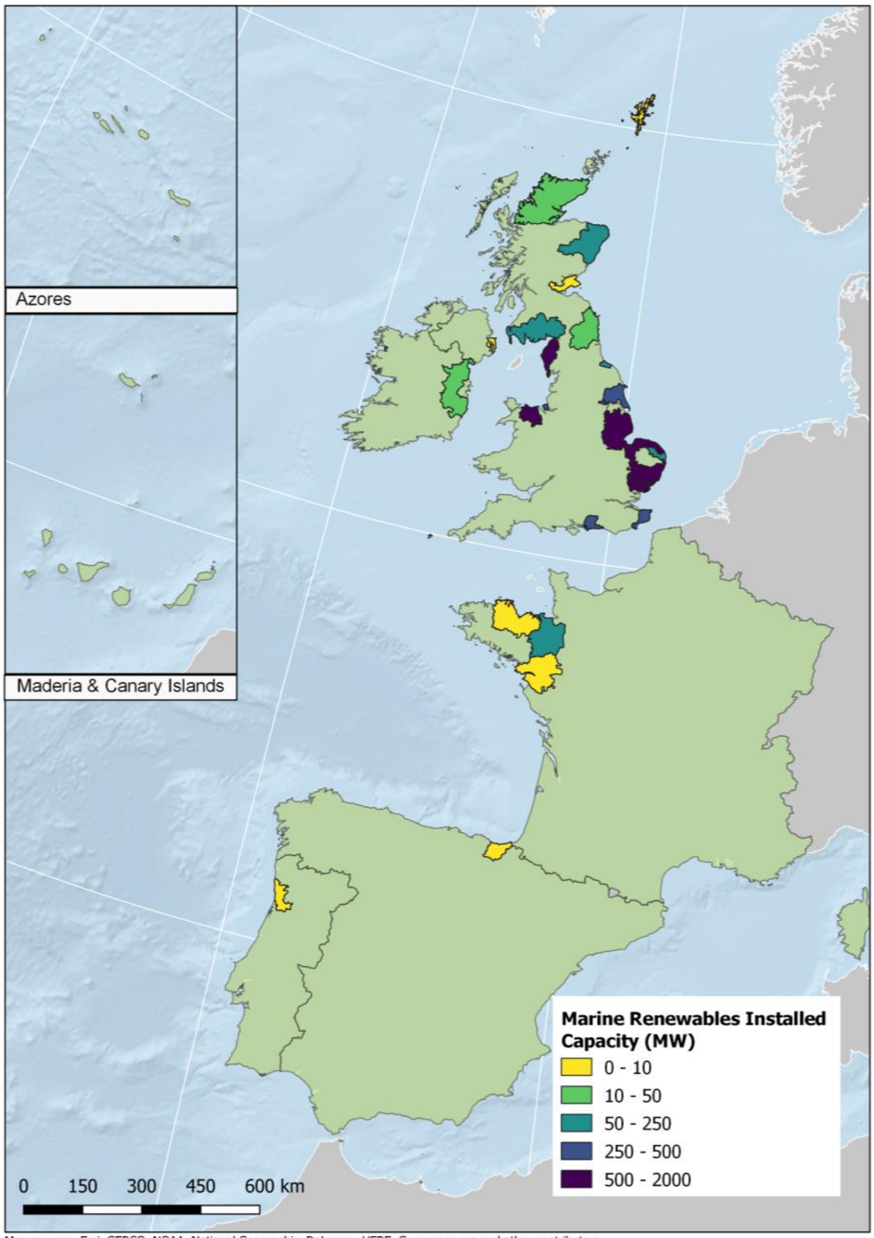


Figure 8. Change in marine renewable energy in the EU Atlantic Area member states broken down by member state.

As shown from the graph above (Figure 8) the UK dominated both the growth and the installed marine renewable energy generation capacity in the period 2013 to 2018 with France the second largest contributor. The contributions of Ireland, Portugal and Spain have been relatively small hence barely showing in Figure 8. Figure 9 show both the location of marine renewables in 2018 and growth during the period 2014-2018 respectively. Both maps show that the capacity, and growth in capacity, while located mainly in the UK is further concentrated into two regions. The first of these regions is in the North Irish Sea, north of Wales and South of Cumbria, while the second region is along the coast of England in the North Sea. This region is responsible for the majority of the marine renewable energy capacity as measured under the AAP and AAP 2.0 of 3,636 MW in 2018, up from 2,963 MW in 2017, consisting of a significant portion of the baseline (7,230 MW) for the AAP 2.0. Also highlighted in the growth map, is the location of regions in France and Portugal where contraction has taken place indicating the removal of some small pilot or demonstration marine renewable projects. Without the UK, due to Brexit, this means that during the period 2016-2018 the remaining four member states in the EU Atlantic Area have seen a loss of install marine renewables from 271.3 MW to 267.3 MW. The two main marine renewable installations remaining as of 2018 in the four remaining member states of the EU Atlantic Area are the French tidal barrier in La Rance (240 MW) and the Irish offshore windfarm in the Arklow Bank (25 MW).



Map sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org and other contributers.
Data source: MOSES project (http://mosesproject.eu/)

Figure 9. Marine renewables installed capacity in 2018

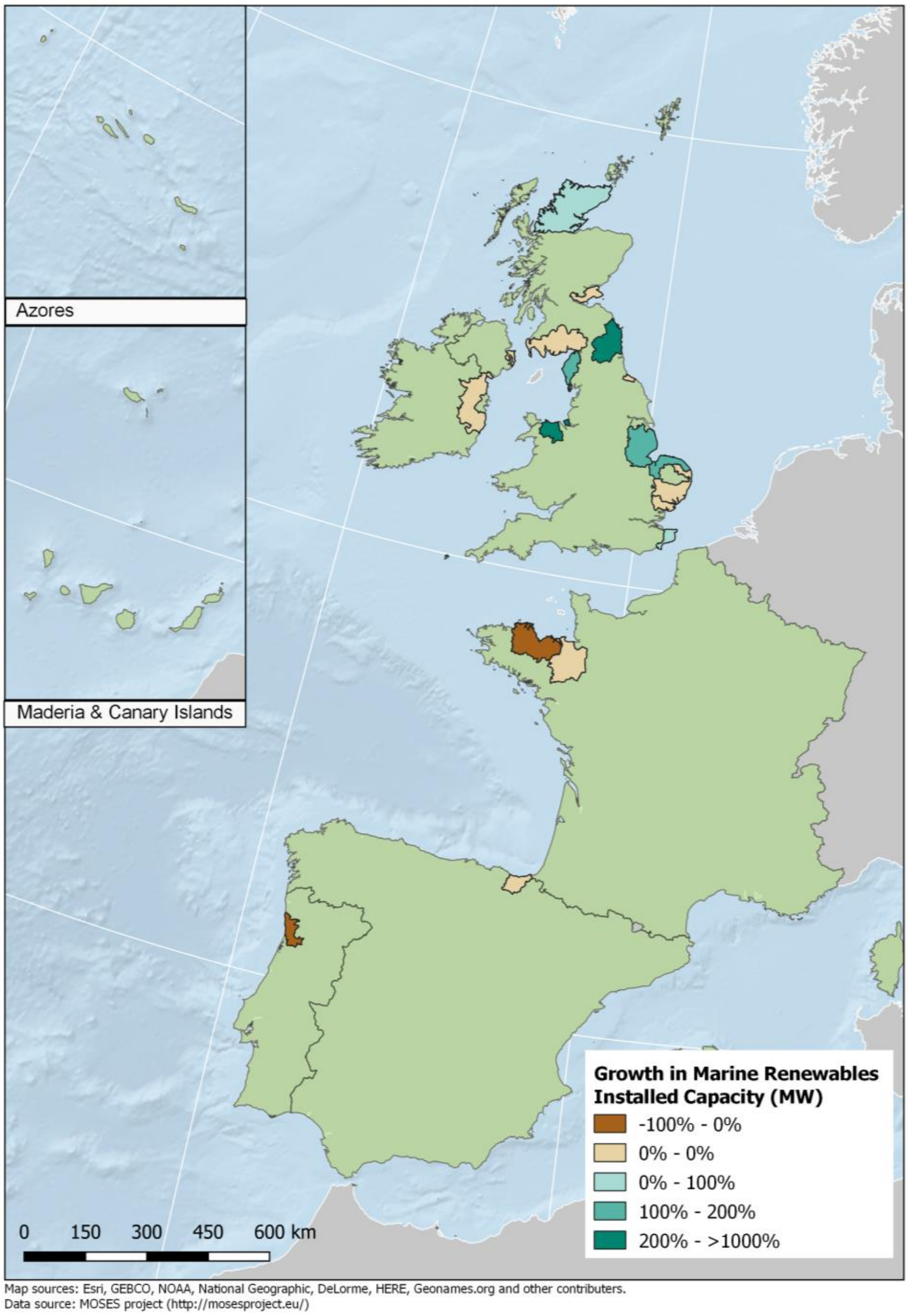


Figure 10. Marine renewables capacity growth from 2014-2018

3.3. Commercial bed nights tourism indicator.

Commercial bed night data was only available at the national level, and it can be seen from Figure 11, that for the EU Atlantic Area member states overall there was an increase from 1.42 billion bed nights to 1.6 billion bed nights, a 12% increase in the period 2014-2019. Most countries saw a rise although the UK appears to have seen a levelling off or slight decrease from 2018 onwards. It is noted, as for other indicators, that this national level data may cross sea basins, particularly the Mediterranean Sea in the case of Spain and France. Therefore, for the EU Atlantic Area breaking these figures down spatially would give a more useful picture for this indicator.

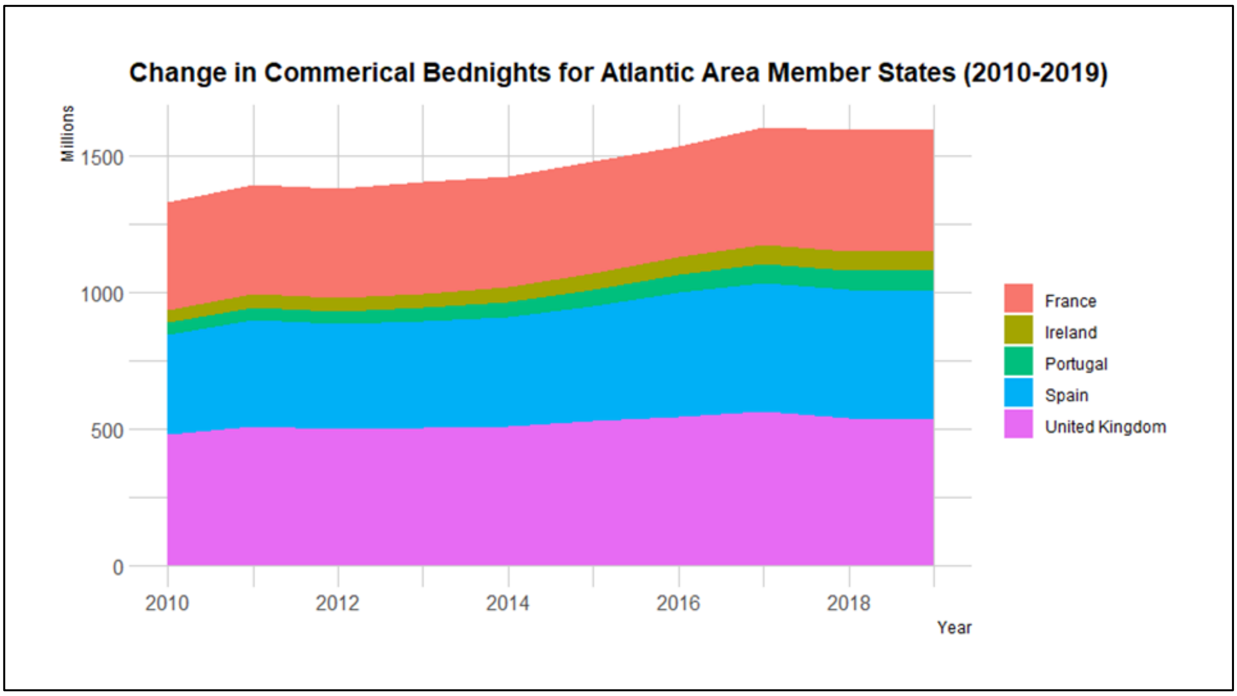


Figure 11. Change in EU Atlantic Area commercial bednights (2010-2019)

It should be noted that only one year (2015) in the MOSES database had enough coverage to give a proper picture of the level of tourism pressure spatially across the EU Atlantic Area due to difficulties in collecting data across all time periods (Figure 12). Also, the UK figures were only available at the NUTS2 region level. However, it is clear that the southern portion of the EU Atlantic Area region, the Algarve and the Canaries show up as hotspots in this analysis. Also standing out within their nations as tourism pressure zones in coastal areas are cities like Dublin and Lisbon. Extending the time series in regards to this indicator could be useful in terms of monitoring the changing pressures on marine resources from marine and coastal tourism as envisaged under pillar 4 of the AAP 2.0.

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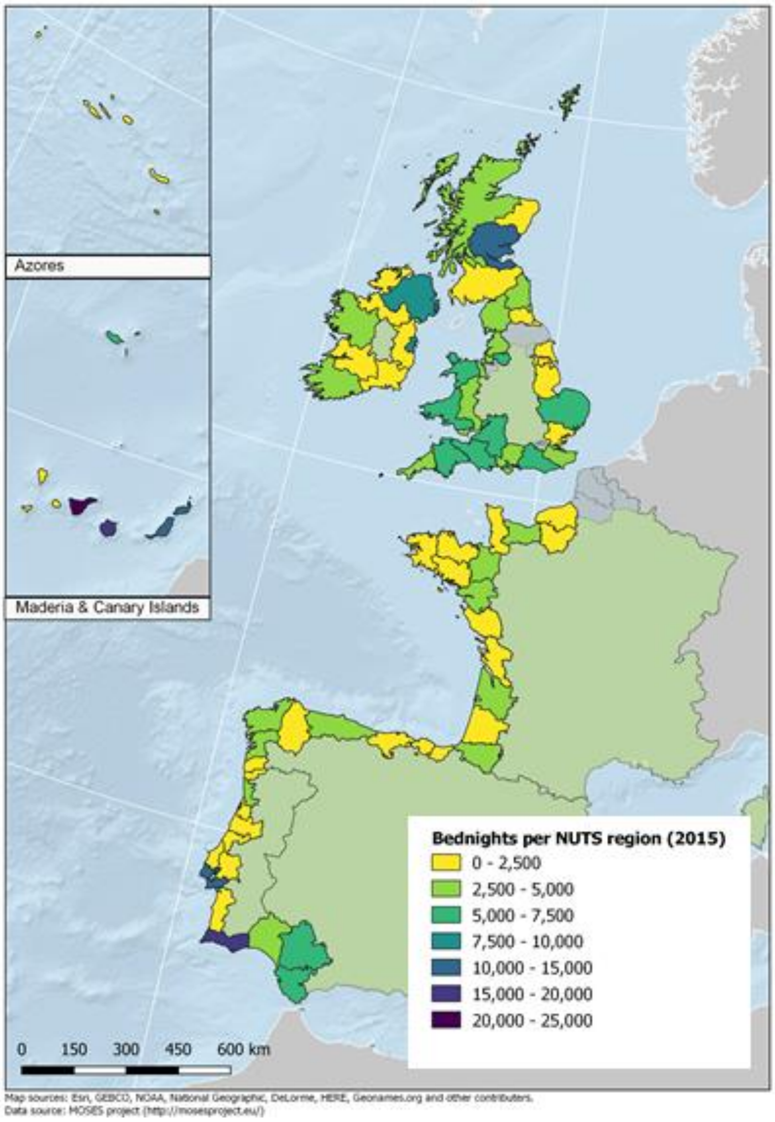

Figure 12. Distribution of commercial bed nights at NUTS 3 level in 2015 for the EU Atlantic Area. Grey indicates missing data.

3.4. Vulnerability indicator

Finally, in terms of the vulnerability indicator developed by MOSES, Figure 12 shows the regional distribution of vulnerability scores and a cartogram of the EU Atlantic Area coastal NUTS3 regions with surface area made proportional to the overall vulnerability scores. The UK was found to have the most vulnerable coastline, with most of its NUTS3 regions above the European Atlantic average vulnerability score. Ireland had the least vulnerable coastline, with many of its' regions below the Atlantic average vulnerability score. However, overall, most of the Atlantic European coast appeared to be quite vulnerable to the analysed pressures. The vulnerability index developed under MOSES provides for a snapshot in time but could be extended to cover different time periods. This could serve to assess the evolution of coastal vulnerability over time in order to help evaluate the degree of success of achieving goals 6 (stronger coastal resilience) and 7 (the fight against marine pollution) under pillar 4 of the AAP 2.0.

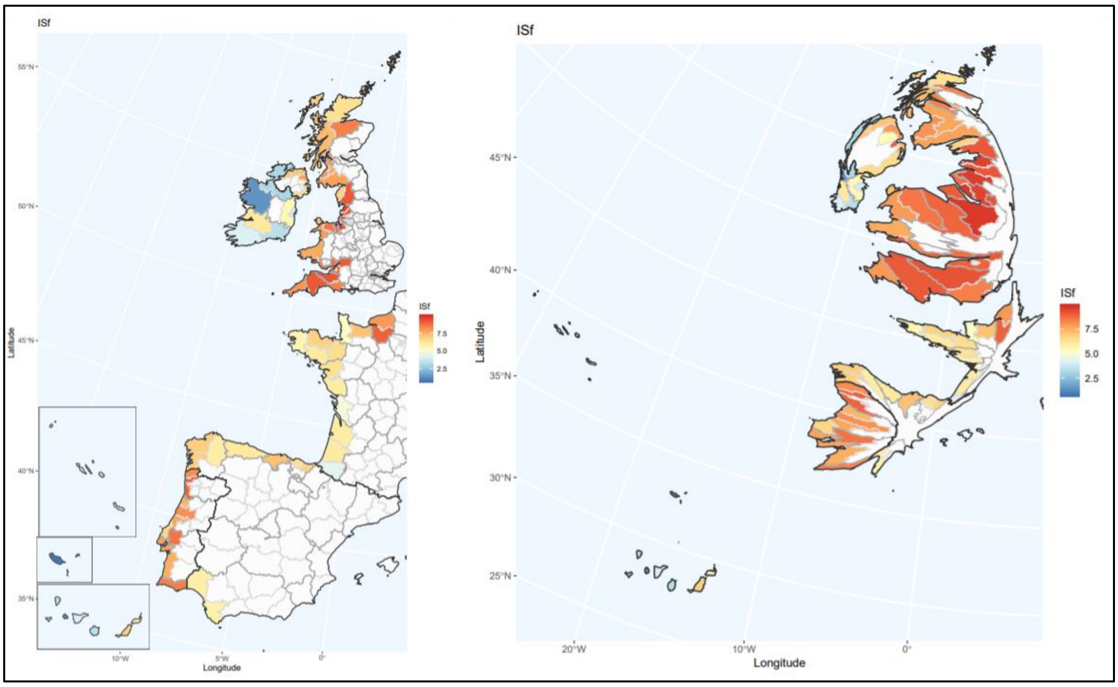

Figure 12. Regional distribution of vulnerability scores and cartogram of EU Atlantic Area coastal NUTS3 regions with surface area proportional to overall vulnerability scores

4. DISCUSSION AND CONCLUSION

This paper highlights the issues in measuring progress under the AAP and for the AAP 2.0 into the future using data and indicators derived from the EU MOSES project. Developing suitable indicators for measurement of the AAP 2.0 needs to be based on the experience from oversight of the AAP and the weaknesses found at the mid-term review (EC, 2018). Obtaining data for certain economic activities (GVA, turnover) for smaller ocean industries at a sub-national level was difficult and impossible for some EU Atlantic Area member states and highlights the need to collect proxies to allow national level data to be disaggregated. The MOSES database collection process also highlighted the need to collect all data across all member states including overlapping sea basins to allocate/validate data at a supranational level and for cross country and sea basin level comparisons.

This can be seen in the case for the marine renewables where measuring at national level across countries bordering two sea basins (in this case the UK across the Atlantic and North Sea) can inflate the baseline. However, the main story for the future of marine renewables in the EU Atlantic Area is that installed capacity is starting from a smaller base relative to the pre-Brexit period with areas of likely focus for future development on the Irish side of the Irish Sea and in the Bay of Biscay.

Brexit is also an issue for the other two indicators discussed in this paper. For short sea shipping, customs rules and other paperwork has made it more attractive for some Irish and EU exporters and importers to move goods directly to the continent rather than the use the previous UK 'landbridge' (Ahearne and Hynes, 2020). This may be a temporary bedding in period for the new trading regime or it could portend a permanent feature of EU Atlantic Area short sea shipping. The other indicator for tourism, commercial bed nights, under normal circumstances could also be affected by Brexit although any effect is overwhelmed by the Covid-19 crises and the travel restrictions both within the EU, the Schengen Area and the Common Travel Area. Inclusion and development of this indicator may help to track and monitor an important sector of the blue economy in the EU Atlantic Area and also provide information on possible areas of pressure for Goal 7 of the AAP 2.0: The fight against marine pollution.

The status of the UK was still left open in the APP 2.0. but many of the indicators within the AAP 2.0. monitoring framework are still using baselines with the UK included. Some, as was shown here with the marine renewables, are also inclusive of other sea basins. The current baselines proposed in the AAP 2.0 will need to be reviewed and already some EU publications (EC, 2021) have moved on with classifying the EU Atlantic Area as just the four remaining EU states of Ireland, France, Spain and Portugal. Finally the vulnerability index developed under MOSES demonstrates how data from a wide variety of sources might be combined to monitor particular goals under the AAP 2.0 from a more holistic perspective.

The European Green Deal (EC, 2019) is the biggest EU policy driver and the marine economy and marine stakeholders across the EU, including the EU Atlantic Area, will require significant changes to meet its goals of carbon-neutrality by 2050. This includes the AAP 2.0 and using two of the indicators and the manner in which they are broken down here highlights one of the challenges, namely the reliance of the short sea shipping sector on movement of liquid bulk, sometimes the largest cargo in the EU Atlantic Area (Figure 4). Liquid bulk is composed mostly of fossil fuel liquids such as crude and refined oil and liquified natural gas and as such attaining carbon neutrality will require reduction of reliance on these. On the other hand, another of the AAP and APP 2.0 indicators used here, installed marine renewable energy, will contribute to the goals of the European Green Deal (EC, 2019)[11]. Thus, in effect the AAP 2.0 may be monitoring opposing indicators in pursuit of the overall goal of reducing fossil fuel use. Therefore, it may be more useful to breakdown short sea shipping by cargo, as was done in this paper and set more specific targets for cargo types in setting future short sea shipping targets.

As noted by Ahearne and Hynes (2020), while the challenges of Brexit, Covid-19 and transitioning to a low carbon future exist, there are also opportunities for marine economies in developing new sources of growth, jobs and economic resilience

[11] The same argument may be made for dry bulk in terms of coal shipping for power plants.

particularly in areas of offshore energy, a needed marine ecosystem restoration industry and coastal and marine tourism.

The former of these is reflected in AAP 2.0 with Pillar II and Goal 5 focused on increasing the generation of marine renewable energy. Encouraging economic recovery after the COVID-19 is also a unique opportunity to tackle ecosystem degradation, biodiversity loss and climate change with a shift in the focus on investment. Marine ecosystem restoration is an emerging blue growth industry that will generate crucial economic values. Borrowing costs for governments and investment-grade corporations trended down over the past 20 years, in part due to the excess of global savings over investment spending. Policy actions by the European Central Bank in responding to the economic and financial fallout from the COVID-19 emergency have driven borrowing costs even lower. This, coupled with the increased focus on a company’s environmental credentials by investors, means that there will be greater opportunities for investing in ecosystem restoration in the post-COVID-19 recovery period. Coastal and marine tourism is currently struggling during the pandemic but will likely return as the EU Atlantic Area’s largest blue economy sector once again. Inclusion of its monitoring at a regional level could ensure policy makers are in a position to alleviate its pressures where they occur and as shown here compiling suitable indicators for this sector is possible.

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APPENDICES

APPENDIX A. MONITORING PROGRAM FOR THE AAP 2.0

Objectives	Indicator description	Type	Related SDG	Data source & collection	Baseline	Target
Pillar I: Ports as blue economy hubs	Ports acting as community managers	Qualitative	9	Evaluation of the Atlantic action plan 2.0 / Stakeholder consultation	No baseline	Stakeholder report activities of ports have evolved by 2025
Goal 1: Ports as gateways for trade in the Atlantic	Short Sea Shipping - weight of goods transported to/from main ports of the Atlantic regions	Quantitative (tonnes)	9	Eurostat [mar_sg_am_ewx] Study for Motorways of the Sea 2018-202151	261 021 kilotonnes (2016)	>0% growth per year
Goal 2: Ports as catalysts for business	Number of ports that have developed a blue growth strategy	Quantitative (number of ports)	9	Evaluation of the Atlantic action plan 2.0 /DG MARE	1 (Port of Vigo)	At least 1 port per Atlantic Member State by 2025
Pillar II: Blue jobs of the future	People employed in blue economy jobs in the Atlantic area	Quantitative (number of people)	8	DG MARE EU Blue Economy Report (2019) and Blue Indicators tool	1,5 million (2016)	>0% growth per year

Goal 3: Quality training and life-long learning	Participation rate in education and training for people over 18 in the Atlantic Member States	Quantitative (number of people)	4	Eurostat (NUTS 2)	12,9% (2016 average), 3,8% lower than EU average	<3,5% lower than EU average by 2025
Goal 4: Ocean literacy	Perceived ocean literacy in coastal regions	Qualitative	14	Evaluation of the Atlantic action plan 2.0 / AORA Working Group on Ocean Literacy	No baseline	Stakeholders report increased ocean literacy by 2025
Pillar III. Marine renewable energies	Installed capacity by technology (MW) in the Atlantic Area	Quantitative	7	JRC (Petten) and EU Blue Economy Report Business and industrial organisations	7,230 MW (2017)	Increased installed capacity in the Atlantic area
Goal 5: Promote carbon neutrality through marine renewable energy	Investments in the offshore wind and ocean energy sectors (sites, technology, machinery etc)	Quantitative	13	JRC (Petten) Business and industrial organisations	2017/2018 figures	Increased investments in capacity and infrastructure in marine renewable energy
Pillar IV: Healthy ocean and resilient coasts	Overall health of the Atlantic Ocean environment	Qualitative	14	MSFD and Ospar assessment Copernicus ocean monitoring indicators	MSFD reports (2018) and Ospar Intermediate Assessment 2017 1st Copernicus Ocean state report (2017)	Improvement of the overall health of the EU Atlantic by the next MSFD reporting round (2024) and next Ospar Assessment (Quality Status Report planned for 2023)

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Goal 6: Enhance Coastal resilience	Percentage of coast vulnerable to erosion	Quantitative	15	European Environment Agency Data and JRC Ispra Blue Economy Report 2018 and 2019 section/case study Copernicus coastal land service	No baseline (latest reports from 2004 show 11%)	Lower than 10% by 2025

APPENDIX B. MAPS SHOWING DIFFERENT DEFINITIONS OF THE EU ATLANTIC AREA

Figure 13. EU Atlantic Area as defined by the IAA Atlantic Area Programme Manual 2014-2020 (IAA, 2021).

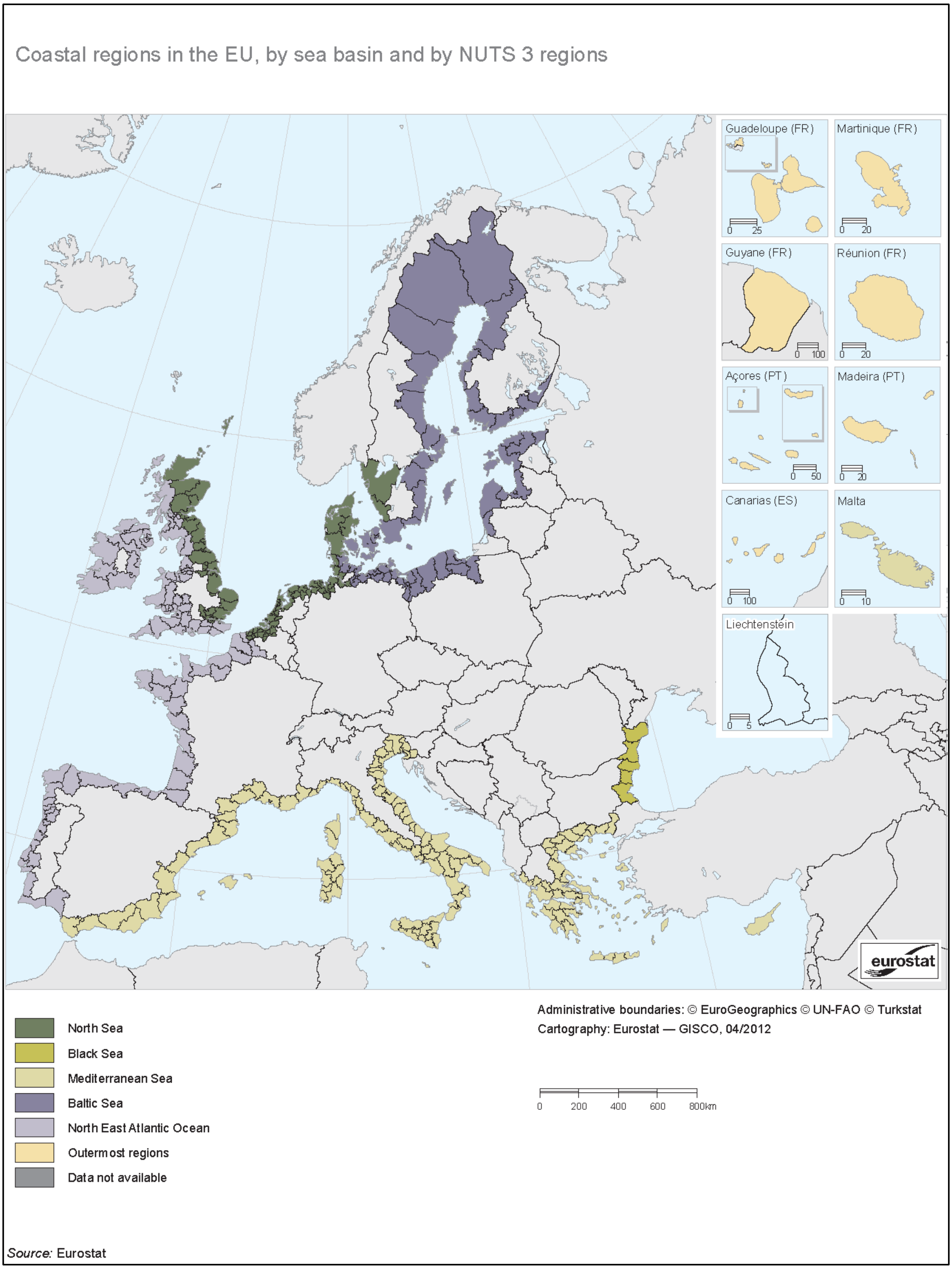

Figure 14. Coastal areas in the EU by sea basin and NUTS3 regions (Eurostat, 2012)

APPENDIX C. METHODOLOGICAL NOTE ON MEASURING SHORT SEA SHIPPING DATA.

Figures produced here are different from those produced by Eurostat for the North East Atlantic Area sea basin as in data used by MOSES does not breakdown partner entity by sea basin for all countries within the dataset. This means that the UK is not split between the North Sea and Atlantic Area, thus all the UK is used. For Spain, there is no breakdown between Mediterranean, South Atlantic and Outermost regions (Canaries), as all are grouped together. Likewise for Portugal there is no breakdown between Atlantic Area and Outermost regions (Azores & Madeira). The French Atlantic coast is separated out from the rest of France.

Using 2016 data from ports in the UK North Sea, the Mediterranean region of Spain and the Outermost regions to the partner entities of Ireland, UK, France (Atlantic Coast), Spain and Portugal, gives an estimate of the shipping between those regions that should be omitted to reach the Eurostat value for short sea shipping in the North East Atlantic Area seabasin. The total of these is greater than the difference between the MOSES Atlantic Area Estimate and Eurostat North East Atlantic Area estimate as internal shipping cannot be separated out. Nonetheless, it gives some information on the levels of shipping in the confounding regions.

Table C1. Short Sea Shipping between MOSES defined Atlantic Area and various sea basins/areas.

Seabasin/Area	Short Sea Shipping (Thousand Tonnes)
MOSES Atlantic Area Estimate	282,938
UK North Sea	57,169
Spain Mediterranean Sea	39,236
Outermost regions of Spain and Portugal	21,254
Eurostat North East Atlantic Area	212,461

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