

# ICES WGRMES REPORT 2017

SCICOM STEERING GROUP ON ECOSYSTEM PROCESSES AND DYNAMICS

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## Report of the Working Group on Resilience and Marine Ecosystem Services (WGRMES)

12–14 July 2017

Vigo, Spain



**ICES**  
**CIEM**

International Council for  
the Exploration of the Sea

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## Executive summary

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The Working Group on Resilience and Marine Ecosystem Services (WGRMES) was established in 2014 (with a kick-off meeting held in A Coruña, Spain, during the ICES ASC 2014) to respond to the high priority research areas of the ICES Science Plan: “Development of options for sustainable use of ecosystems”; it is also transversally related with the first and second thematic areas “Understanding Ecosystem Functioning” and “Understanding Interactions of Human Activities with Ecosystems”.

The WGRMES successfully held three meetings in 2015 (Vigo, Spain), 2016 (Porto, Portugal) and 2017 (Vigo, Spain).

During the meetings, the WGRMES members revised each of the four priorities of the ToRs:

- a) Marine ES under the Blue Growth Agenda and socioeconomics of marine ES;
- b) Synergies and trade-offs between marine ES;
- c) Small-scale fisheries and marine ES; and
- d) Social transformations of marine social-ecological systems (new ToR).

Under these four topics, WGRMES identified and investigated which research priorities are key to advance in the development of the scientific knowledge that impacts the spatial distribution of marine Ecosystem Services (ES) at multiple scales (local, regional, national and international). Within each topic, WGRMES made important contributions to the current scientific challenges about marine ES not only in Europe but also globally.

## 1 Administrative details

### Working Group name

Working Group on Resilience and Marine Ecosystem Services (WGRMES)

### Year of Appointment

2015

### Reporting year within current cycle (1, 2 or 3)

3

### Chair(s)

Sebastian Villasante, Spain

Gonzalo Macho, Spain

### Meeting venue(s) and dates:

12–13 May 2015; Vigo, Spain (22 participants)

13–15 June 2016; Porto, Portugal (12 participants + 2 remotely)

12–14 July 2017; Vigo, Spain (9 participants + 3 remotely)

## 2 Terms of Reference a) – z)

- a) Identify the emerging tools and methodologies of socio-economic dimension of marine ES;
- b) Understand the dynamics of spatial distribution and potential conflicts between marine ES and users;
- c) Economic valuation of marine ES under a changing climate;
- d) Understand the social consequences of changes in ES, including “social transformations”;
- e) Understand the ecological, economic, cultural and social factors underlying the use of marine ES;
- f) Inform decision makers on alternative strategies for the use of ES under different scenarios.

## 3 Summary of Work plan

Year 1	Review of existing methodologies and tools of socio-economic dimensions of marine ecosystem services.
Year 2	Spatial estimates of economic valuation of marine ecosystem services.
Year 3	Understanding of ecological, economic, cultural, social factors and uses of marine ecosystem services and locations.

## 4 Summary of Achievements of the WG during 3-year term

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- Review of availability of global and European datasets;
- Identification of research gaps from the scientific literature;
- Global literature review and research priorities on marine and coastal ES;
- Compilation of available information of cultural marine and coastal ES globally;
- Creation of a global database on social transformations of marine ES;
- Presenting socioeconomic information on marine ES, and identification of synergies and trade-offs for a number of case studies;
- Three postdocs (2015–2017) working on recreational and commercial ES;
- Development of 8 PhD thesis on the topic of marine and coastal ES in EU countries and beyond at Campus Do Mar-International Campus of Excellence;
- Submission of 3 national-EU research projects (2 of them were funded and currently underway);
- Publication of several scientific papers about marine and coastal ES (list of key publications):

Carpenter, G., Villasante S., O’Leary B. 2016. Europe: Keep allowable fish catches sustainable. *Nature* 531 (7595): 448.

Rivero-Rodriguez, S., Villasante, S. 2016. What are the research priorities for marine ecosystem services. *Marine Policy* 66:104–113.

Selig, E., Kleisner, K., Ahoobim, O., Arocha, F., Cruz-Trinidad, A., Fujita, R., Hara, M., Laure Katz, McConney, P., Ratner, B., Saavedra-Díaz, L., Schwarz, A-M., Thiao, D., Torell, E., Troëng, S., Villasante, S. 2016. A typology of fisheries management tools: using experience to catalyse greater success. *Fish and Fisheries*. DOI: 10.1111/faf.12192.

Villasante, S., Pita, C., Pierce, G., Pazos Guimeráns, C., Garcia Rodrigues, J., Antelo, M., Da Rocha, J.M., García Cutrín, J., Hastie, L., Sumaila, R., Coll, M. 2016. To land or not to land: How do stakeholders perceive the zero discard policy in European small-scale fisheries? *Marine Policy* 71:166-174.

Villasante, S., Pazos Guimerans, C., Rodrigues, J., Antelo, M., Rivero Rodríguez, S., Pita, C., Pierce, G., Lee, H., Garcia, D., Da Rocha, J.M., Sumaila, R., Coll, M. 2016. Fishers' perceptions about the EU discards policy and its economic impact on small-scale fisheries in Galicia (North West Spain). *Ecological Economics* 130:130-138.

Bas Ventin, L., Troncoso, J., Villasante, S. 2015. Towards adaptive management of the natural capital: Disentangling trade-offs among marine activities and seagrass meadows. *Marine Pollution Bulletin* 101 (1): 29-38.

Coll, M. *et al.* (including Villasante). 2015. Modelling dynamic ecosystems: venturing beyond boundaries with the Ecopath approach. *Reviews in Fish Biology and Fisheries* 25(2): 413-424.

Outeiro, L. *et al.* (including Villasante). 2015a. Framing local ecological knowledge to value marine ecosystem services for the customary sea tenure of aboriginal communities in Southern Chile. *Ecosystem Services* 16:354-364.

Outeiro, L. *et al.* (including Villasante). 2015. Using ecosystem services mapping for marine spatial planning in Southern Chile under scenario assessment. *Ecosystem Services* 16:341-353.

- Roldán, V., Villasante, S. 2015. Linking marine and terrestrial ecosystem services through governance social networks analysis in Central Patagonia (Argentina). *Ecosystem Services* 16:390-402.
- Stefansky, S., Villasante, S. 2015. Whales vs. gulls: Assessing trade-offs in wildlife and waste management in Patagonia, Argentina. *Ecosystem Services* 16:294-305.
- Villasante, S., Lopes, P., Coll, M., 2015. The role of marine ecosystem services for human well-being: Disentangling synergies and trade-offs at multiple scales. *Ecosystem Services* 17:1-4.
- Villasante, S., Rivero Rodríguez, S., Molares, Y., Martínez, M., Remiro, J., García-Díez, C., Lahoz, C., Omar, I., Bechardas, M., Elago, P., Ekandjog, M., Saisaig, M., Awity, L. (2015) Are provisioning ecosystem services from rural aquaculture contributing to reduce hunger in Africa? *Ecosystem Services* 16: 365-377.

## 5 Final report on ToRs, workplan and Science Implementation Plan

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Analysis of the expected deliverables in each ToR initially agreed by the WG:

**a) Identify the emerging tools and methodologies of socio-economic dimension of marine ES (Science Plan Topic Addressed: Resilience properties of marine ES. Marine living resource management tools)**

A1. List of potential needs from clients and stakeholders from an online questionnaire.

An online questionnaire has not been finished yet but several stakeholders (ARVI Fishing Cooperative, Galician Aquaculture cluster, Galician Fisheries Administration) were invited to the first WG meeting held in Vigo in 2015. Stakeholders presented their vision, problems and needs on the subject. Based on this meeting a collaboration with ARVI come up in the project "Social transformations of marine social-ecological systems" funded by ICES in which the purse seine fishery targeting pelagic fishes (one of the main fleets of interest for ARVI) was one of the case studies included.

A2. Theme Session at the ICES ASC in Spain (2014). A Theme Session entitled "Resilience and Marine Ecosystem Services" and co-organized by S. Villasante and G. Macho.

A3. Special Issue "Resilience and marine ecosystem services" *ICES Journal of Marine Science* (to be published during 2015).

This deliverable was not achieved as conceived since the editor of the journal did not accept most of the papers presented for the SI. Nevertheless, another SI was organized entitled "Operationalizing marine and coastal ecosystem services" in the *International Journal of Biodiversity*, leaded by J. Garcia Rodrigues, S. Villasante, C. Kermagoret, C. Liqueste, N. Beaumont, V. Drakou, what will be published during the year 2017. Moreover, a paper on resilience was published; Li, C., Villasante, S., Xueqin, L. (2016) Resilience and thresholds in marine social- ecological systems: the case study of the Argentinean hake fishery. *Environment and Development Economics* 65:623.

doi: [10.1007/s10640-016-0038-y](https://doi.org/10.1007/s10640-016-0038-y).

A4. Scientific paper about research priorities of marine ES in Europe. This paper was published; Rivero-Rodriguez, S., Villasante, S. 2016. What are the research priorities for marine ecosystem services? *Marine Policy* 66:104–113. The results of this study show that topics related to Linking ES and wellbeing, and Integrating economics, natural and social sciences into ecosystem services assessments are the most important research issues.

Clearly, the two research topics Linking ES and wellbeing and Integrating natural science, economics and social sciences into ES assessments rose to the top of the list, and were regarded by stakeholders as crucial topics to advance practical application of the ES approach in coastal and marine social-ecological systems. The research done also indicate that questions concerning the interplay between ecosystems and people were found to be more important than instrumental questions. The top ten research questions prioritized by respondents fell into six research topics (ordered by importance) are the following: Wellbeing, Trade-offs, Function, Integration, Metrics, Drivers, Tools, and Valuation.

**b) Understand the dynamics of spatial distribution and potential conflicts between marine ES and users (Biodiversity and the health of marine ecosystems. Marine spatial planning)**

B1. Scientific paper about spatial distribution of marine ES in ICES ecoregions. This deliverable was not achieved as originally conceived since the WG decided to focus only of cultural ES for a global analysis and on case studies initiatives. Following this one paper was published (Garcia Rodrigues J. *et al.*, 2017. Marine and Coastal Cultural Ecosystem Services: knowledge gaps and research priorities. *One Ecosystem* 2: e12290) and another one is under review (Outeiro, L., *et al.*, 2017. The role of non-natural capital in the co-production of marine ecosystem services. *International Journal of Biodiversity Science, Ecosystem Services & Management*).

In Garcia Rodriguez *et al.* (2017) the objectives were (1) to analyse the state of research on marine and coastal CES, (2) to identify knowledge gaps, and (3) to identify research priorities and pinpoint the move forward. To accomplish these objectives, we did a systematic review of the scientific literature and synthesised a subset of 72 peer-reviewed publications. Results show that research on marine and coastal CES is scarce compared to other ecosystem service categories. It is primarily focused on local and regional sociocultural or economic assessments of coastal ecosystems from Western Europe and North America. Such research bias narrows the understanding of social-ecological interactions to a western cultural setting, undermining the role of other worldviews in the understanding of a wide range of interactions between cultural practices and ecosystems worldwide.

Our literature synthesis revealed that economic drivers negatively affect the provision of practically all CES classes (Figure 1). Several publications listed this type of drivers in a general and aggregate manner, but others specified the type of economic drivers affecting CES, namely economic growth, damming, tourism, land reclamation, to name a few.

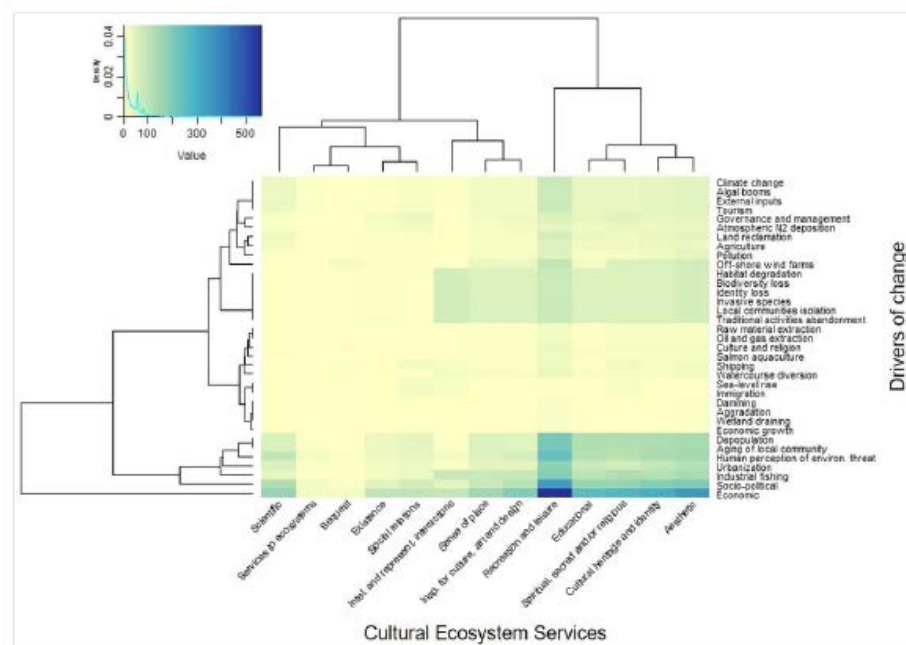


Figure 1. Drivers of change affecting marine and coastal CES classes. Dendrograms represent similar drivers grouped by hierarchical clustering on the Euclidean distance between the rows and columns of the matrix, according to the number of links found in the literature review.

Also, two main clusters of drivers primarily affect a set of CES composed by recreation and leisure, aesthetic amenities, cultural heritage and identity, spiritual, sacred and/or religious experiences, and educational services. The main cluster of drivers includes depopulation, aging of local community, human perception of environmental threat (public opinion about areas potentially under environmental threat such as pollution, toxins, debris, etc.), urbanization, industrial fishing, and socio-political and economic drivers. A second cluster of drivers affects primarily the same set of CES plus the group 'intellectual and representative interactions'. This cluster is composed by traditional activities abandonment, local communities' isolation, identity loss, invasive species, habitat degradation, and biodiversity loss. A common characteristic in the composition of these two clusters is a set of economic, demographic, sociocultural and ecological drivers that together negatively affect marine and coastal CES.

Additionally, we have identified clusters of co-occurring drivers of change affecting marine and coastal habitats and their CES. Our systematic review highlights knowledge gaps in: (1) the lack of integrated valuation assessments; (2) linking the contribution of CES benefits to human wellbeing; (3) assessing more subjective and intangible CES classes; (4) identifying the role of open-ocean and deep-sea areas in providing CES; and (5) understanding the role of non-natural capital in the co-production of marine and coastal CES. Research priorities should be aimed at filling these knowledge gaps. Overcoming such challenges can result in increased appreciation of marine and coastal CES, and more balanced decision-supporting mechanisms that will ultimately contribute to more sustainable interactions between humans and marine ecosystems.

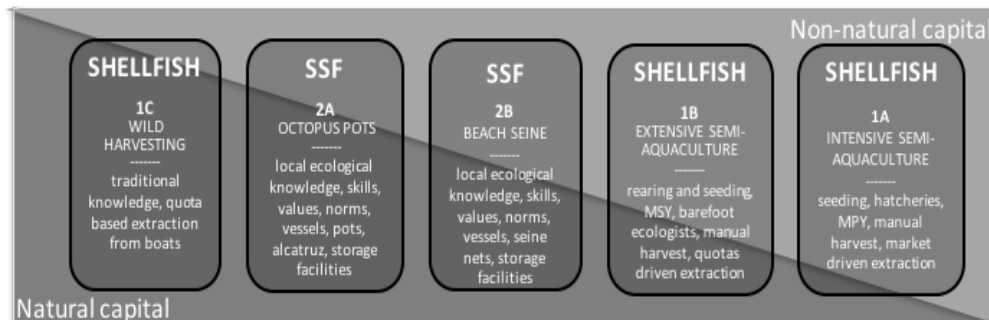
On the other hand, in Outeiro, L., *et al.* (2017) we contribute to the current scientific discussions on social and ecological interactions associated with the provision of marine ES

(Carpenter *et al.*, 2009) by analysing case studies from marine social-ecological ecosystems in Northern Portugal and Galicia (Spain).

We analyse five marine harvesting systems: two small-scale fisheries in Northern Portugal and three small-scale shellfisheries in Galicia. The latter show an intensity gradient from intensive semi-aquaculture to wild harvesting. Jointly assessing these five study cases may allow us to test whether co-production increases from wild fisheries to aquaculture (Palomo *et al.*, 2016). One of the main questions regarding co-production is to what extent social-ecological interactions can deliver ES in a sustainable way. In fact, trade-offs among ES can favour one service over the other with a subsequent degradation of the system that can lead to the detriment of other ES (Villasante *et al.*, 2016). In spite of the relevance of co-production processes for marine SESs, little is known about how various interactions between ecological and social systems determine ES provision. We argue that special care needs to be placed on the concept of co-production and associated trade-offs so that any human interaction with ecosystems at any scale could be recognized as a win-win situation.

We provide new insights into this knowledge gap by looking at different levels of interaction between natural and non-natural capital in marine SES to understand possible trends in the provision of marine ES and benefits. We give special attention to trade-offs between ES and levels of co-production (i.e., social-ecological interactions). To design our study, we have unfolded the co-production concept focusing on the intensity and the nature of the ES production process. We examine examples of trade-offs in detail in our case studies and explore their relation to the type and co-production intensity, assessing ES and ecosystem disservices at the local and regional scale.

To compare and analyse the five different case studies presented here. Figure 2 illustrates the position of each of them with respect to the level of co-production. Based on the description of the case studies we can place them depending on the expected level of co-production in a gradient of natural and non-natural capital inputs, following Palomo *et al.* (2016).



**Figure 2. Gradient of marine ecosystem service co-production based on inputs of natural and non-natural capital in the Galician and Northern Portugal shellfish fisheries and small-scale fisheries (SSF) (based on Palomo *et al.*, 2016).**

The harvesting system with the largest use of non-natural capital is intensive intertidal semi-aquaculture, as it uses all the forms of non-natural capital (human, social, manufactured, financial capital). Thus, this activity is the most reliant in co-production in terms of

obtaining ES and benefits. The second most important activity using non-natural capital is the extensive semi-aquaculture which needs almost the same practices as intensive semi-aquaculture but at a lower intensity level, using all the forms of non-natural capital except financial capital. The small-scale fishing systems present a decreasing level of reliance on non-natural capital but still using human, social and manufactured capital. The wild harvesting is mostly reliant on natural capital with the lowest level of co-production using mainly human and some sort of manufactured capital with small boats and power engines

B2. Create a Database for ICES with detailed information of ecosystem services locations by using case studies across ICES ecoregions.

This deliverable was achieved by focusing on Cultural ES and with a worldwide distribution. The Cultural Marine Ecosystem Services Dataset includes information about cultural marine ES globally. We are currently in touch with the ICES Secretariat and ICES Data Centre to provide open access to this database on the ICES website.

**c) Economic valuation of marine ES under a changing climate (Socio-economic understanding of ecosystem goods and services)**

C1. Create a Database for ICES with detailed information of economic valuation of marine ES.

Two members of the group (S. Villasante and A. Lillebo) are co-directing a PhD student on this subject (Marco Custodio, University of Aveiro, Portugal) at Campus Do Mar-International Campus of Excellence. The PhD thesis is elaborating a global database from a systematic literature review within different databases, namely Scopus, ISI Web of Knowledge, Science Direct and Wiley Online Library. To identify relevant publications the search looks for the following keywords (*["fisheries" OR "aquaculture"] AND ["economic valu\*" OR "economic valorization" OR "economic assessment" OR "valu\*" OR "valor\*"] AND ["ecosystem service\*" OR "natural capital"]*) on article title, abstract and keywords, or only on abstracts, depending on the searching options available on the bibliographic databases.

C2. Theme Session "Managing marine ecosystem services in a changing climate" at 2015 ICES Conference (Denmark). This Theme Session was done co-organized by S. Villasante, M. Barange and K. Criddle (PICES).

C3. Scientific paper about the socioeconomic contribution of marine ES to coastal communities in ICES ecoregions. Marco Custodio (co directed by S. Villasante and A. Lillebo from the WG) is preparing a review paper about the economic valuation of marine ES provided by fisheries and aquaculture globally.

C4. Plan a Workshop to inform policy makers and clients. This deliverable was not achieved yet but currently underway.

C5. Plan to publish a Special Issue "Impacts of climate changes on marine ES". This deliverable is currently organizing.

**d) Social transformations of marine social–ecological systems (this new ToR was adopted instead of the original one: Understand the ecological, economic, cultural and social factors undermining the use of marine ES)**

Under the new ToR several deliverables were achieved:

D1. A Workshop on Small-scale fisheries and social transformations has been organized by members of the WGRMES (C. Pita, Portugal), with the participation of several other members of the group (S. Villasante, A. Himes-Cornell). The workshop was funded by the EUROMARINE call and it was held in Brest, France.

D2. A Database was created. The Social Transformation Dataset provides a high-quality, descriptive, open-source information resource for the scientific community, ecosystem managers and the sectors related to the marine ecosystem (i.e. fisheries, aquaculture and canning industry). In collaboration with the ICES secretariat, we are currently investigating a possibility of providing open access to this database on the ICES website.

D3. A Special Issue was organized entitled “Operationalizing marine and coastal ecosystem services” in the International Journal of Biodiversity, led by J. Garcia Rodrigues, S. Villasante, C. Kermagoret, C. Lique, N. Beaumont, V. Drakou, that will be published during the year 2017.

D4. A Theme Session at 9th ESP Conference 2017 “Ecosystem services for the eco-civilization” to be held in China on December 2017 entitled “The role of social sciences in ecosystem services valuation” that is co-organized by S. Villasante, S. Chen and H. Zheng.

D5. The WG has started to write a paper on “Tipping points and transformative changes of marine ES”, led by S. Villasante, G. Macho to be published on 2018.

**e) Inform decision makers on alternative strategies for the use of ES under different scenarios (Socio-economic understanding of ES)**

The group was not able to focus on this ToR and the expected deliverables were not achieved (1-Development of guidelines to manage marine ES for policy makers and industry and 2-Plan a Workshop to inform policy makers and clients at ICES Secretary).

The WG has instead been working on creating an online questionnaire for the fishing sector and administrations on recent problems and adaptive strategies to face them. Results from this work will be presented at the ICES ASC Conference 2018.

Another way of involving decision and policy makers will be by the link of the WGRMES with the ECOMAR research network. In this network members of the WG will be working and leading several case studies in which public administrations are involved; the National Park of Illas Atlánticas in Galicia (Spain), the Fishing Reserve of Os Miñarzos in Galicia (Spain), NE Spanish Mediterranean (Spain), Arrabida Marine Park (Portugal) and Berlengas National Park (Portugal).

## 6 Cooperation

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### Cooperation with other WGs

The working group has established contact to the following working groups:

- Working Group on Comparative Analyses between European Atlantic and Mediterranean marine ecosystems to move towards an Ecosystem-based Approach to Fisheries (WGCOMEDA);
- Working Group on Social and Economic Dimensions of Aquaculture (WGS-EDA);
- Working Group on Ecosystem Assessment of Western European Shelf Seas (WGEAWESS);
- Strategic Initiative on the Human Dimension (SIHD).

### Cooperation with Advisory structures

- European Parliament, Committee for Fisheries;
- Xunta de Galicia, Spain;
- Delivery of results for national governments in Spain and Portugal for the holistic integrated assessment of marine ecosystem services.

The working group has established contact with the DGMare, the European Parliament, and EUROPECHE, to explore the signature of a memorandum of understanding as a possible vehicle to ask specific scientific questions with respect to the overarching themes of the WG.

Following the memorandum of understanding that will exist between the three organizations; the WG can develop as an important vehicle in perusing this collaboration between both ICES and other institutional organizations. Based on the paper published by members of the WGRMES, (Rivero and Villasante (2016) Marine Policy 66: 104-113), one of the objectives of the 2018 meeting will be to synthesize which or the general and specific scientific questions that will be approached by WGCOMEDA topic may have socio-economic and management implication both in the Atlantic and the Mediterranean systems for the DGMare, European Parliament and the fishing industry.

### Cooperation with other IGOs

- Relevant groups at the Ecosystem Services Partnership: Working Group on Economic and Monetary Valuation of ecosystem services, and Marine Working Group;
- Marine Stewardship Group at Future Earth Program.

## 7 Summary of Working Group self-evaluation and conclusions

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The first benefit is the gathering of an interdisciplinary group of scientists across the European Union together to exchange knowledge, experience and insights about the current status of marine ecosystem services. Before this group, there was no organized effort to

work together consistently, this group provides opportunities to address key questions globally as well as locally and expanding human resources and empirical evidence of critical research gaps from the scientific community.

## Annex 1: List of participants

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## Annex 2: Recommendations

RECOMMENDATION	ADDRESSED TO
1. WGRMES will acknowledge the accessibility of results generated to other WGs as well as to the ICES Data Centre in order to succeed in the ToRs and specific objectives.	ICES Data Centre
2. WGRMES members agree ICES may take the initiative to promote a MoU between ICES, DGMare, EU Parliament and the fishing industry towards a more cooperative studies of marine ecosystems that facilitate a collaborative exploitation and open access of data.	Council
3. Delegate members of WGRMES to PICES Conferences.	SCICOM and ACOM
4. Social sciences for marine ecosystem services valuation.	Training Group

### Annex 3: WGRMES draft resolution 2018–2020

The **Working Group on Resilience and Marine Ecosystem Services** (WGRMES), chaired by Sebastian Villasante, Spain, and Gonzalo Macho Rivero, Spain, will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2018	12–14 June	Stockholm, Sweden	Interim report by 1 August	
Year 2019	12–14 June	Copenhagen, Denmark	Interim report by 1 August	
Year 2020	10–12 June	Vigo, Spain	Final report by 1 August	

#### ToR descriptors

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
A	Resilience of marine ecosystem services	Information and data on marine ES is scarce and not organized. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas, and WGs described above	Resilience and properties of marine ES. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas	1 year	-Interim report -Global review paper: Key drivers for resilient small-scale fisheries. -Memorandum of Understanding with EU institutions and fishery organizations -Online repository with results from year (2015-2017)
B	Multidimensional valuation of marine ecosystem services	Valuing marine ES is key for policy makers. Regional and local data is lacking in Europe. Links to ICES Science Plan 1st and 2nd Thematic Areas; and WGs described above	Biophysical, economic, cultural and institutional understanding of ecosystem goods and services. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas	2 years	-Interim report -Paper review about intrinsic, instrumental and relational values of marine ES -Special Session at ASC 2018 -Special Session at PICES 2018 -Extended version of the online repository

C	Co-production of marine ES	Marine ES services are co-produced by a mixture of natural capital and various forms of social, human, financial and technological capital. Human intervention in the co-creation of marine ES is a key driver in ES delivery,	Several ICES thematic areas. ICES Action area: ecosystem overview, integrated ecosystem assessment, MSFD, Sustainable aquaculture	2 years	-Interim report -Special Session at ASC 2019 -Special Session at AAA Conference 2019 -Global paper about co-production of marine ES -Special Issue <i>"Blue Growth under the Anthropocene"</i>
D	Tipping points and social transformations of marine ES	Document critical changes which facilitate transformations of social groups. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas, and WGs described above and below. Links to the Strategic Initiative on the Human Dimension	Human dimensions of the oceans. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas	2 years	-Interim report -Global paper documenting social transformations of marine ES. -Special Session at ASC 2020 -Special Issue <i>"Tipping points and social transformations of marine ES"</i>
E	Governance and scenarios for sustainable marine ES	The role of institutions is key to develop assessments of best practices of integrated assessments of marine ES		3 years	-Interim report -Global paper on governance of

### Summary of the Work Plan

Year 1	Review of existing frameworks, methodologies and tools to study socio-economic dimensions of marine ecosystem services
Year 2	Understanding of ecological, economic, cultural, social drives of changes of marine ecosystem services
Year 3	Scenarios and policy recommendations for resilient trajectories of marine ecosystem services

### Supporting information

Priority	High. The current activities of this Group will lead ICES into issues related to marine ecosystem services, integrating fisheries management and ecosystem services frameworks. Consequently, these activities are considered to have a very high priority.
Resource requirements	None required other than those provided by the host institute.
Participants	The Group is normally attended by some 15 members and guests.
Secretariat facilities	None.
Financial	No financial implications. The WGRMES will explore to get funds from H2020 calls and others to support and expand the activities inside and outside Europe
Linkages to ACOM and groups under ACOM	AFWG, WGECO, WGRFS
Linkages to other committees or groups	There is a close working relationship with WGBIODIV, and also EPISG EGs (WGMHM, WGMPCZM, WGSFD), SICCME, WGIMM, WGLMEBP, WGISUR, WGMARS, and BONUS.
Linkages to other organizations	The work of this group is aligned with other global nodes of ES research such as the Ecosystem Services Partnership in which the one of the chair (Dr. Villasante) is also co-leader of the Thematic Working Group “Economic and monetary valuation” and ( <a href="http://www.es-partnership.org">www.es-partnership.org</a> ). The work is also in line with the current Future Earth Program, the Natural Capital Project ( <a href="http://www.naturalcapitalproject.org/">http://www.naturalcapitalproject.org/</a> ), ++ and numerous scientific and regulatory governmental and university’s departments in ICES countries.

## Annex 4: Copy of Working Group self-evaluation

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- 1) ICES Working Group on Resilience and Marine Ecosystem Services (WGRMES).
- 2) Year of appointment: 2015
- 3) Current Chairs: Sebastian Villasante and Gonzalo Macho
- 4) Venues, dates and number of participants per meeting:
  - 12–13 May 2015, Vigo, Spain, (22 participants)
  - 13–15 June 2016, Porto, Portugal, (12 participants + 2 remotely)
  - 12–13 July 2017, Vigo, Spain, (9 participants + 3 remotely)

### WG Evaluation

- 5) If applicable, please indicate the research priorities (and sub priorities) of the Science Plan to which the WG make a significant contribution.
  - 5.1) Identified key global research priorities on marine ecosystem services
  - 5.2) WGRMES contributed to goals 1, 2, and 3 of the ICES Science Plan
  - 5.3) Compilation and evaluation of relevant international datasets
  - 5.4) Knowledge gaps of marine ES have been identified and addressed
  - 5.5) Understanding interactions between human activities, ecosystem services within ecosystems
  - 5.6) Development of governance tools for sustainable use of marine ecosystem services
- 6) In bullet form, list the main outcomes and achievements of the WG since their last evaluation. Outcomes including publications, advisory products, modelling outputs, methodological developments, etc. \* Publications, papers, reports, ...
  - 6.1) Global data compilation of cultural marine and coastal ecosystem services
  - 6.2) Global documentation of case studies including social transformations of marine social-ecological systems
  - 6.3) Assessment of local case studies
  - 6.4) 8 PhD Thesis at Campus Do Mar-International Campus of Excellence about marine and coastal ecosystem services to be defended during the 2017-2020 period.
- 7) Has the WG contributed to Advisory needs? If so, please list when, to whom, and what was the essence of the advice.
  - 7.1) Advisory needs have not been defined but it will be done after an EU consultation to industries (e.g., fisheries and aquaculture) and institutions (e.g., STEFC, DGMare and European Parliament, etc.). There is no request for advice right now. However, the WGRMES has been identified key global research priorities on marine ecosystem services.

- 8 ) Please list any specific outreach activities of the WG outside the ICES network (unless listed in question 6). For example, EC projects directly emanating from the WG discussions, representation of the WG in meetings of outside organizations, contributions to other agencies' activities.
  - 8.1 ) Presentations and participation at ICES Conferences
  - 8.2 ) Participation at JIP Oceans workshops
  - 8.3 ) EU projects: INTERREG (Cephys and Chefs; 2017-2020) and AQUADAP (Spanish) projects emanated from the WG cooperation.
  - 8.4 ) Transnational projects: ECOMPAR Iberoamerican network - Evaluation and monitoring of marine and coastal ecosystem services (2016-2020) (Chair: S.Villasante).
  - 8.5 ) Global cooperation: members of the WGRMES are co-leading the Marine Stewardship Group at the Future Earth Initiative.
  - 8.6 ) Creation of a Working Group on small-scale fisheries in Galicia (NW Spain).
- 9 ) Please indicate what difficulties, if any, have been encountered in achieving the workplan.
  - 9.1 ) The main difficulty is the financial resource allocated to members of the WGRMES to attend annual meetings.
  - 9.2 ) The WG started from a low base with respect to the availability of information in order to identify a clear agenda to provide short and long terms advice.

### Future plans

- 10 ) Does the group think that a continuation of the WG beyond its current term is required? (If yes, please list the reasons)
 

Yes.

  - 10.1 ) To complete compilation of data, drivers, and changes of marine ES
  - 10.2 ) To better understand the co-production processes of marine ES
  - 10.3 ) To investigate the role of tipping points when managing ES
  - 10.4 ) To evaluate the potential benefits of MPAs for sustainable marine ES
  - 10.5 ) To generate links of ecosystem services valuation to integrated assessment of marine ecosystems
  - 10.6 ) To provide policy recommendations to ICES and EU institutions about resilient and sustainable trajectories of marine ES
  - 10.7 ) To maintain and increase the network of experts on marine ES in the EU
- 11 ) If you are not requesting an extension, does the group consider that a new WG is required to further develop the science previously addressed by the existing WG.
- 12 ) What additional expertise would improve the ability of the new (or in case of renewal, existing) WG to fulfil its ToR?
  - 12.1 ) Improve links with other ICES WGs

- 12.2 ) Participation of WGRMES members outside the ICES community
- 12.3 ) Promote the participation of facilitators to create interfaces between the ICES community, marine industries and the society.
- 12.4 ) WGRMES lacks experts on political sciences.
- 13 ) Which conclusions/or knowledge acquired of the WG do you think should be used in the Advisory process, if not already used? (please be specific)
  - 13.1 ) Better integration of concepts, frameworks and tools to investigate marine ES into the fisheries management in the EU
  - 13.2 ) There is still low knowledge on the socio-economic impacts of the fisheries administration decisions for a better-informed decision making process.
  - 13.3 ) The majority of successful case studies analysed about marine ES are based on the active participation of stakeholders during the decision making process.
  - 13.4 ) The Advisory process should ask the WGRMES for advice on key research questions in the EU.

## Annex 5: Updated tables

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Social transformations database

Case study template

**GREEN = Free text, paragraph style**

**BLUE = Free text, brief keywords**

**RED = Choose from predefined keyword alternatives**

**BLACK= Optional information**

### BASIC INFORMATION OF THE CASE STUDY

**1. Main Contributors** (surname, name, institution and email address)

**2. Name of the case study**

Short name for the case study (e.g. North sea cod fishery)

**3. What is the social transformation is your case study? (Please keep in mind that the transformation might generate desirable (+) or undesirable (-). You can choose more than one option. Add other options in case of necessary for your case study).**

- Restructuring the sector: \_\_
- Employment opportunities: \_\_
- Changes in catches: \_\_
- Diversification of seafood markets: \_\_
- Diversification of fishing grounds: \_\_
- Migration of people from coastal communities to: \_\_
- Cultural diversity: \_\_
- Other (please specify): \_\_

**4. How desirable (+) or undesirable (-) has been the social transformation in your case study?**

- |                                       |                                     |
|---------------------------------------|-------------------------------------|
| • Restructuring the sector:           | Desirable__ Undesirable__ Unknown__ |
| • Employment opportunities:           | Desirable__ Undesirable__ Unknown__ |
| • Changes in catches:                 | Desirable__ Undesirable__ Unknown__ |
| • Diversification of seafood markets: | Desirable__ Undesirable__ Unknown__ |
| • Diversification of fishing grounds: | Desirable__ Undesirable__ Unknown__ |

- Migration of people from coastal communities: Desirable\_\_ Undesirable\_\_ Unknown\_\_
- Cultural diversity: Desirable\_\_ Undesirable\_\_ Unknown\_\_
- Other (please specify):\_\_

**5. What region is the case study located in?**

**6. What country is the case study located in?**

**7. What ecosystems are located in the case study area?**

- Marine
- Coastal
- Freshwater systems
- Other (please specify):\_\_

**8. What species do fishers/aquaculture farmers/canned enterprises target in your case study?**

- Fishes  
Demersal (e.g., hake, cod and haddock)  
Pelagic (e.g., sardines, anchovies)
- Crustaceans (e.g., lobsters)
- Mollusks (e.g., cephalopods)
- Other (please specify): \_\_

**9. What types of economic activities are examined through in your case study?**

- Aquaculture
- Large scale commercial fisheries
- Small-scale commercial fisheries (e.g. < 25 meters longitude)
- Canned industry
- Shellfish gathering
- Other (please specify):\_\_

**10. Which marine ecosystem service(s) are been affected by the social transformation in your case study?**

- Products obtained from ecosystems (e.g. fish as food, medicinal resources including pharmaceuticals, chemical models)
- Benefits obtained from the regulation of ecosystems (e.g. carbon sequestration, climate regulation, waste decomposition, purification of water and air, disease control)

- Non material benefits obtained from ecosystems through cultural (use of nature as motif in books, film, painting, folklore, national symbols, architect, advertising), spiritual and historical (use of nature for religious or heritage value or natural), recreational (ecotourism, outdoor sports, and recreation), science and education (use of natural systems for school excursions, and scientific discovery)

**11. How many sector(s) the social transformation impact? (Can be single, two or multiple sectors)**

- One sector (e.g. industrial fisheries)
- Two sectors (e.g. small-scale fisheries and industrial fisheries or aquaculture)
- Multiple sectors (more than two, e.g., small-scale and industrial fisheries, aquaculture, canned industry)

**12. What are the key characteristics of the management system in your case study before and after the social transformation (please select more than one option if necessary)**

**Before the transformation**

- Effort management system
- Lack of local leadership
- Strong local leadership
- Individual transferable quotas
- Lack of co-management
- Strong co-management system
- Marine protected area
- Top-down system
- Other (please specify):\_\_

**After the transformation**

- Effort management system
- Lack of local leadership
- Strong local leadership
- Individual transferable quotas
- Lack of co-management
- Strong co-management
- Marine protected area
- Top-down decision making
- Other (please specify):\_\_

**13. What are the key stakeholders in your case study?**

- Administrations (regional or national) (Regional)
- Scientists
- NGOs
- Key leaders of coastal communities: the fishers community leaving from this activity
- Others (please specify):\_See below

**14. What is the spatial scale of your case study?**

- Local/seascape (e.g. local, community, regional)
- National (country)
- Transnational (e.g. more than one region or country)
- Sub-continental (e.g. Southern Europe)
- Continental (e.g. Europe)
- Global

**15. What are the key drivers of change in your case study (Please select the most important one, mark as many as you need and add other options as necessary)**

- Change in costs for the economic activity (e.g. increase fuel oil)
- Change in governance systems (e.g. from centralized to co-management, from sectorial to integrated management, etc.)
- Change in social benefits (e.g. social security benefits)
- Climate change impacts (e.g. migration of fish species, level sea rise, increase of temperature)
- Environmental shocks (e.g. forest fires, oil spills, hurricanes, etc.)
- Overexploitation or overfishing (e.g. collapse of species)
- High mortality of fish farming (e.g. bacteria or virus)
- Introduction of new regulations (e.g. EU landing obligation, introduction of marine protected areas, co-management systems, individual transferable quotas systems)
- Introduction of new technology (e.g. fishing gear or GPS on board)
- Interaction with other activities (e.g. development of new activities which displace traditional ones)
- Introduction of new infrastructures (e.g. port development, windmills)
- Introduction of invasive species impacts (e.g. local habitat damage)
- New way of selling fish products (e.g. new presentations or new products)
- Non-compliance of fisheries policies (e.g. insufficient TAC/quota, IUU activities)
- Market demand for seafood
- Other (please specify):\_\_\_\_\_

**16. What are the impacts of the social transformation on marine ecosystems' components of your case study?**

- Key commercial species (e.g., cod, hake, anchovy)
- Other commercial species (not yet established or unknown)
- Non commercial species (not yet established or unknown)
- Habitats (not yet established or unknown)
- Entire ecosystem
- Other (please specify):\_\_

**17. What are the impacts of the social transformation on human wellbeing?**

- Food security and nutrition\_
- Income and employment\_
- Security of housing and infrastructure\_
- Leisure and recreation\_
- Cultural heritage\_
- Social relations \_
- No direct impacts
- Others (e.g., demography, health, education, etc.)\_\_

**18. What is the time scale over which social transformation occurred in your case study?**

- Months
- Years
- Decades
- Unknown

**19. How reversible do you think this change is?**

- Irreversible (on 100 year time scale)
- Difficult to reverse
- Easy to reverse
- Unknown

**20. What are the sources of evidence used in your case study (please add others in case of necessary)**

- Field work
- Time series
- Models
- Local ecological knowledge
- Literature references
- Other (please specify): \_\_\_\_\_

**21. How robust is the evidence in your case study to demonstrate that a social transformation exists?**

- Speculative – Social transformation has been proposed, but little scientific evidence as yet
- Contested – Reasonable evidence both for and against the existence of change
- Well established – Wide agreement that the social transformation exists

**22. What are the barriers for adaption after social transformation?**

In your case study, what are the barriers (if any) that fishers, enterprises and institutions are facing in relation to current social transformations in your case study to navigate into successful adaptive strategies to deal with the change.

**23. What are adaptive strategies adopted after social transformation?**

Describe what are/were the innovative adaptive strategies developed by key actors (e.g. enterprises, institutions, fishers, etc.) to deal with the transformation.

**24. What are the key references used in your case study**

Please provide key sources to get more information about the case study (e.g. scientific papers, reports, grey literature, newspapers, etc.)

**25. Diagrams, Photos and Videos**

Please provide diagrams, photographs or videos that illustrate the social transformation in your case study. Include a caption as well as the source. Only include material that can be freely distributed.

**Additional comments**

Please provide any additional comment you consider necessary to describe your case study.

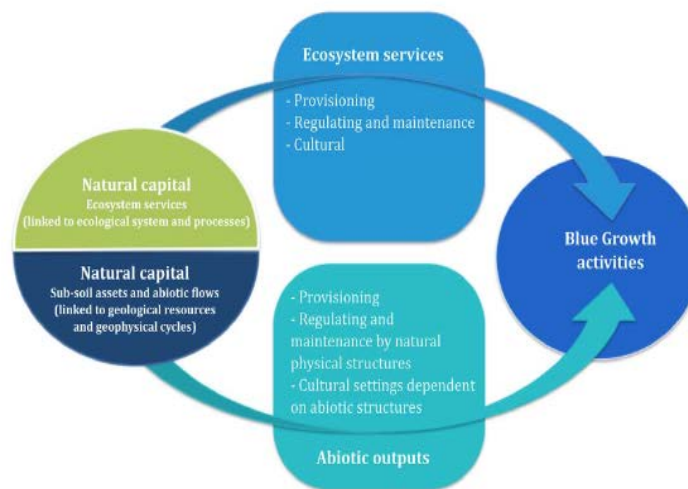
**Thank you for your collaboration!**

## Annex 6: Progress report of the 2017 meeting

During 2017, WGRMES addressed each of the four priorities/ ToRs: a) Marine ES under the Blue Growth Agenda and socioeconomics of marine ES; b) Synergies and trade-offs between marine ES; c) Small-scale fisheries and marine ES; and d) Social transformations of marine social-ecological systems (new ToR).

### Topic 1: Marine ES under the Blue Growth Agenda and socioeconomics of ES

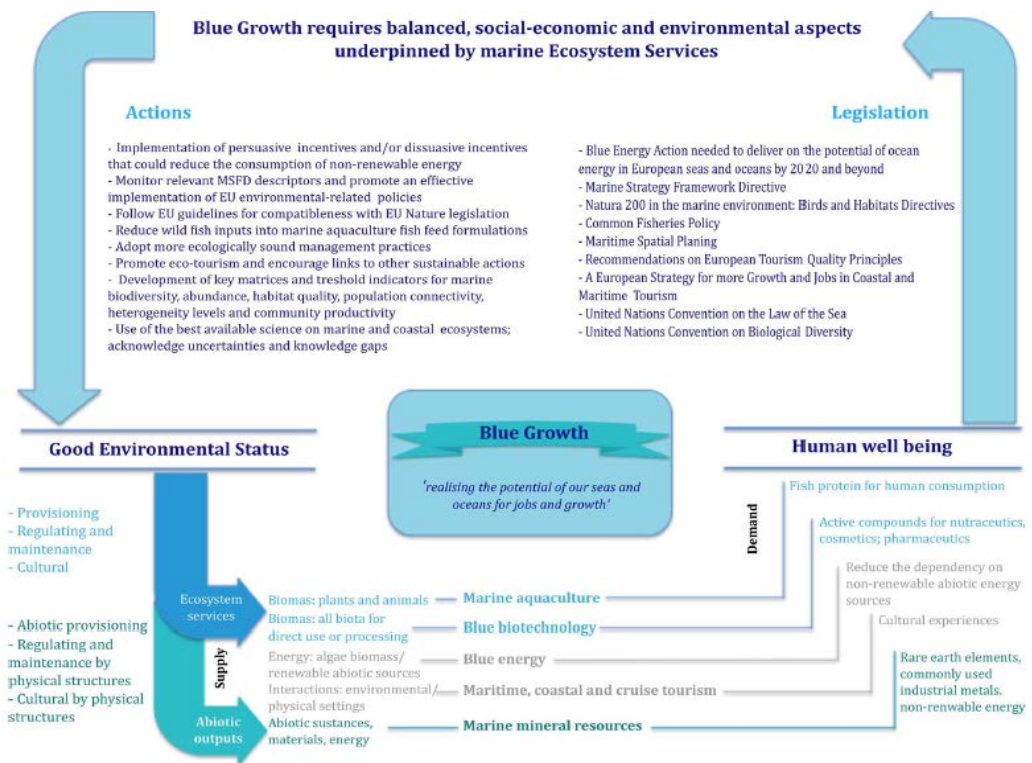
We developed and published the paper “How can marine ecosystem services support the Blue Growth agenda?” (Marine Policy, 2017 (81): 132-142) analyses Blue Growth activities with regards to the demand and supply of marine ES and Good Environmental Status (GES). The results show that marine provisioning ES support aquaculture and blue biotechnology, while blue energy is supported by marine provisioning ES and by abiotic provisioning, and abiotic provisioning supports extraction of marine mineral resources.



**Figure 1. Schematic representation of how natural capital supports the Blue Growth activities following the Common International Classification of Ecosystem Services (CICES) latest version.**

Figure 1 shows that the demand for ES is social and economically driven, and in the case of the Blue Growth agenda, there is the demand for: fish protein for human consumption; active compounds for nutraceuticals, cosmetics and pharmaceuticals; reduction of the dependency on non-renewable abiotic energy sources; cultural experiences; and demand for rare earth elements, commonly used in industrial metals and non-renewable energy.

Maritime, coastal and cruise tourism is supported by cultural marine ES and cultural settings dependent on marine abiotic structures. All these multi-sectoral economic activities depend on healthy marine and coastal ecosystems that are provided by regulating and maintenance ES combined with the abiotic regulation and maintenance by natural marine physical structures and processes.



**Figure 2.** Schematic representation of how marine ecosystem services (ES) can support the Blue Growth agenda, taking into account the demand for marine ES and the actions regulated by legislation that are needed for the supply of the required services in a sustainable way. Source: own elaboration.

This figure shows the links between the demand for ES that are driven by the Blue Growth agenda's economic activities (blue energy, aquaculture, maritime, coastal and cruise tourism, marine mineral resources, and blue biotechnology) and the supply side for ES. In addition, it should be noted that marine ecosystems could be negatively impacted by these economic activities, if such activities are not properly regulated and managed, halting marine ecosystems' capacities to provide the demanded ES. Therefore, research is needed on the impacts from these multiple human activities taking place in the maritime, marine and coastal space on marine ES. In this sense this work establishes the first step to establish the links between marine ES and the economic-related activities included in the Blue Growth agenda.

In order to balance concurrent sectoral interests and achieve sustainable use of marine resources there is the need to consider indicators for demand for ES, which are social and economically driven, and for the supply, which are dependent on ecosystems capacity to provide the required marine ES. Some of the actions foreseeing GES are already anticipated in legislation that underpin Blue Growth, whilst others could benefit from additional regulation, particularly in what concern the exploration and exploitation of marine mineral and biological resources. Blue Growth options require navigating trade-offs between economic, social and environmental aspects.

## Topic 2: Synergies and trade-offs between marine ES

WGRMES worked on the co-production mechanisms of marine ES. Co-production of ES has been described as how interactions between people and ecological systems that result in the provision of ES. Marine ES assessments need to consider non-natural capital inputs (e.g. financial, technology, energy inputs) that contribute to some ES delivery, as they affect the way we evaluate the broad notion of sustainability. The role of co-production has also been explicitly acknowledged as a key idea in the science–policy interface. The Millennium Ecosystem Assessment explicitly acknowledged the role of different capital types in the co-production of ecosystem services a decade ago.

More recently, the conceptual framework of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) states that both ‘nature’ and other ‘anthropogenic assets’ jointly contribute to the provision of ecosystem services for human well-being. The Sustainable Development Goals (SDGs) by United Nations also acknowledged that food is co-produced by nature and different types of human capitals. Understanding how natural capital and other forms of capital (including human, social, manufactured and financial) are combined to co-produce different marine ES, types, quantity and quality of ES will give us a better understanding of the dynamics of marine social–ecological systems and their implications for policy.

Our hypothesis is that marine ES services are co-produced by a mixture of natural capital and various forms of social, human, financial and technological capital. We will test this hypothesis by empirically examining the role of humans in the generation of marine ES, and the factors that might help us to understand diversity in these processes. The hypothesis will be tested by using three methods: a) inventory of co-production examples in marine social-ecological systems, b) an international expert consultation, and c) development of a local interviews program in key selected case studies.

First, we will do an inventory of co-production processes of marine ES globally. What experiences have been made, what lessons and conclusions have been drawn and what have been key issues for advancing collaboration/key challenges for further inclusion of the co-production of marine ES in integrated assessments of marine socio-ecological systems. The inventory will go through existing documentation from international and national agencies, other authorities and research institutions that have documented information from current or finished research projects about and/or including the physical and cognitive types of co-production. We will compare and contrast these diverse experiences through quantitative and qualitative and scientific analytical methods, as well as through qualitative, descriptive methods. The material gathered, and the synthesis conducted, will be shared by and discussed with a range of stakeholders in a workshop format.

Based on the existing evidence, we will mobilize our international scientific networks (e.g., Future Earth, Ecosystem Services Partnership, etc.) through workshops with experts to synthesize existing knowledge associated with the co-production of marine ES in order to ensure that no key examples from the inventory is missing, and help us to extract insights and lessons from our international inventory. Finally, we will also use the conceptual framework developed by Palomo *et al.* (2016) to conduct interviews and questionnaires with key stakeholders (e.g., fishers, enterprises, ONGs, policy makers) to study in deep the role of different forms of natural and non-capital in the ES delivery

across a selected number of case studies. We will particularly explore the co-production pathways and their effects on ES quantity and quality, associated trade-offs, resilience and social equity. Co-production analysis at local scale will help to better identify the effects of co-production on the final distribution of ES, their benefits and costs. Such distribution of the costs of coproduction and the benefits of the resulting services is a key (often implicit) policy question that affects the equity of well-being in society.

Based on these background and research priorities, we have developed and submitted (accepted) the paper “The role of non-natural capital in the co-production of marine ecosystem services” (International Journal of Biodiversity Science, Ecosystem Services and Management). This article contributes to the current scientific discussions on social and ecological interactions associated with the provision of marine ES by analysing case studies from marine social-ecological ecosystems in Northern Portugal and Galicia (Spain), two countries where marine activities are highly relevant for coastal communities.

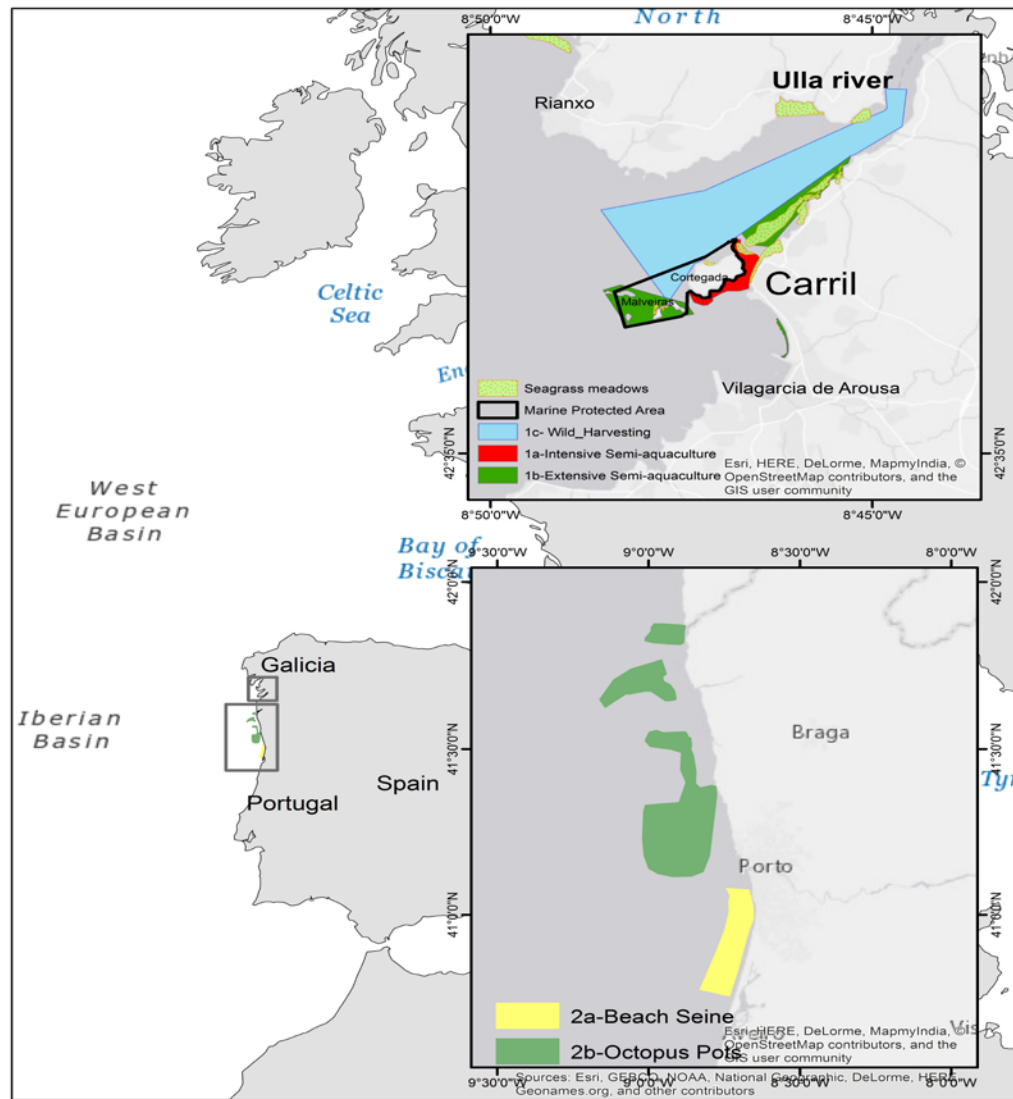


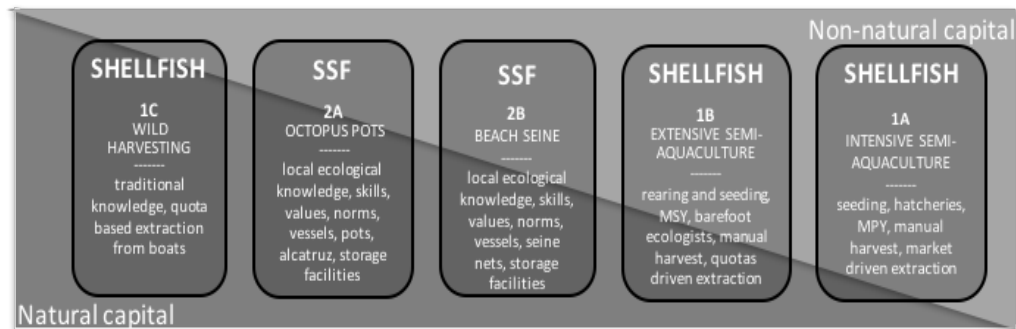
Figure 1. Location of the case studies in Ría de Arousa (Galicia, NW Spain) and Northern Portugal. The figure of Northern Portugal was adapted from Gaspar and Pereira (2014).

We analyse five marine harvesting systems: two small-scale fisheries in Northern Portugal and three small-scale shellfisheries in Galicia. The latter show an intensity gradient from intensive semi-aquaculture to wild harvesting. Jointly assessing these five study cases may allow us to test whether co-production increases from wild fisheries to aquaculture (Palomo *et al.*, 2016). One of the main questions regarding co-production is to what extent social-ecological interactions can deliver ES in a sustainable way. In fact, trade-offs among ES can favour one service over the other with a subsequent degradation of the system that can lead to the detriment of other ES (Villasante *et al.*, 2016). In spite of the relevance of co-production processes for marine SESs, little is known about how various interactions between ecological and social systems determine ES provision. We argue that special care needs to be placed on the concept of co-production and associated trade-

offs so that any human interaction with ecosystems at any scale could be recognized as a win-win situation.

We provide new insights into this knowledge gap by looking at different levels of interaction between natural and non-natural capital in marine SES to understand possible trends in the provision of marine ES and benefits. We give special attention to trade-offs between ES and levels of co-production (i.e., social-ecological interactions). To design our study, we have unfolded the co-production concept focusing on the intensity and the nature of the ES production process. We examine examples of trade-offs in detail in our case studies and explore their relation to the type and co-production intensity, assessing ES and ecosystem disservices at the local and regional scale.

To compare and analyse the five different case studies that we present here, Figure 2 illustrates the position of each of them with respect to the level of co-production. Based on the description of the case studies we can place them depending on the expected level of co-production in a gradient of natural and non-natural capital inputs, following Palomo *et al.* (2016).



**Figure 2.** Gradient of marine ecosystem service co-production based on inputs of natural and non-natural capital in the Galician and Northern Portugal shellfish fisheries and small-scale fisheries (SSF); (based on Palomo *et al.*, 2016).

The harvesting system with the largest use of non-natural capital is intensive intertidal semi-aquaculture, as it uses all the forms of non-natural capital (human, social, manufactured, financial capital). Thus, this activity is the most reliant in co-production in terms of obtaining ES and benefits. The second most important activity using non-natural capital is the extensive semi-aquaculture which needs almost the same practices as intensive semi-aquaculture but at a lower intensity level, using all the forms of non-natural capital except financial capital. The small-scale fishing systems present a decreasing level of reliance on non-natural capital but still using human, social and manufactured capital. The wild harvesting is mostly reliant on natural capital with the lowest level of co-production using mainly human and some sort of manufactured capital with small boats and power engines.

Figure 3 shows the relative position of each of the case studies that we explored in a two-way graph, depicting the level of co-production and the ES trade-offs. For example, Galician intensive semi-aquaculture shows the largest trade-offs which are paired with a high intense use of human, manufactured and financial co-production, which can affect the

provision of habitat ES (e.g., nursery habitat area for squid or other species) and regulating ES (nutrient cycling).



**Figure 3. Relationships between co-production level and trade-offs associated with marine ecosystem service and benefit provision for the Galician and Northern Portugal shellfish fisheries and small-scale fisheries (SSF).**

Following the decreasing limb of co-production and trade-offs is the extensive semi-aquaculture, with same needing practices of intervention in the environment but in a less intensive pattern. However, this harvesting system is also associated with cultural ES and can provide important benefits from shellfish-based tourism. An order below in generating trade-offs and co-production dependence are the two small-scale fisheries from Northern Portugal. The beach seine fishery depends more on human capital and manufactured capital to obtain provisioning ES and potentially generates more trade-offs between provisioning and regulating ES. Due to the low level of manufactured capital and the complete absence up to now of human intervention on river banks, the wild shellfish harvesting scores the lowest level of co-production while a low level of regulating ES compromises. All five case studies vary in an exponential fashion in the level of co-production based on the capital inputs needed for service delivery

### Topic 3: Small-scale fisheries and marine ES

Two papers are currently under development around this topic of the WGRMES:

Paper 1: Global analysis of marine ES provided by industrial vs small-scale fisheries (led by C. Pita)

Paper 2: Key drivers for resilient small-scale fisheries (lead by C. Montero)

#### **Topic 4: Social transformations of marine ES**

The general objective of this topic is to investigate the social transformations of MSE systems. This will be done by investigating global cases of social transformation and the reasons for such transformation and a detailed study of key case studies in Europe.

The specific objectives of project were:

- a) Investigate what are the type and magnitude of the social transformation experienced by these relevant MSE systems and, what type of (un)predictable changes are currently driving these transformations,
- b) Reconstruct social transformations to investigate how natural capital, institutions and the fishers' organizations responded to ecological, economic and institutional drivers and changes during the last decade.

In order to address each of these objectives, we used two methodological approaches. First, we have developed a systematic literature review to collect all available information about social transformations. This report presents main preliminary findings achieved during the development of the tasks proposed in the project. The work will continue with further refinement of these results and description of social transformations during the year 2017.

#### **Methods applied**

##### **Literature review**

To date there has been no systematic review of the social transformation of marine SES globally. Such a review serves as a decision-making framework for determining which critical factors may have greater impacts in achieving integrated understanding of marine ecosystems from an interdisciplinary perspective. The literature review included peer-reviewed literature to identify studies documenting the large social transformations and key factors explaining them. This analysis will enable us to know the previous and current status of the marine SES after the occurrence of the large social transformation as well as to develop the content of the questionnaire for the expert consultation.

Systematic reviews are standardised guidelines for the search and reviews of scientific studies and for the recording of the results that is guided by explicitly structured research techniques. This approach was followed here to investigate whether or not social adaptation, changes and transformations have been addressed by the scientific community. The systematic review has been also done to identify what are the key drivers and impacts which are documented and usually lead to social transformations in the marine arena. The process of sourcing and selection of studies for detailed review is summarised in Figure 5.

We searched for scientific papers published between 1950–2015 period in the Web of Scopus, by using the following criteria: “resilience”, OR “shift”, OR “change”, OR “transform”, OR “adapt”, OR “transition”, AND “marine”, OR fisheries”, AND “social”. No geographical boundaries were stated in the selection criteria as preliminary test. Searches included all articles published until our cut-off date of 31 December 2015. These articles

were then filtered at three different stages of detail, each filter excluding studies which are not related to the key words used in the search. A total of 456 articles were sourced from peer-reviewed literature and as a consequence of the filters and selection criteria employed and described above, 122 articles were reviewed fully in detail.

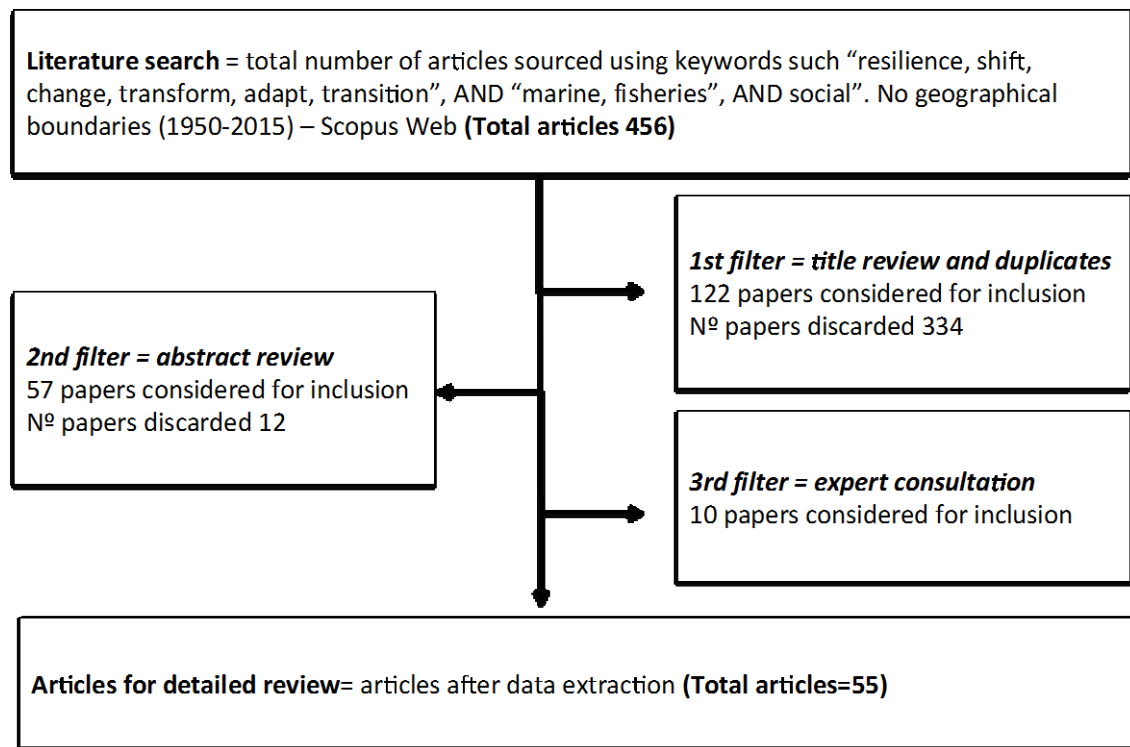


Figure 5. Schematic representation of the systematic literature review.

Of these, 60 articles were used for data extraction and 56 were finally included in the analysis which explicitly addressed the topic of social transformation. We found a considerable asymmetry in the number of studies available for the fisheries sector. The findings were also grouped according whether or not the studies effectively addressed the topic of social changes or transformations in each reviewed paper.

Before starting the data collection, we carried out a ‘calibration’ exercise to attain a uniform data collection procedure among co-authors. This consisted of reviewing a randomly selected publication that had been previously identified for quantitative synthesis. Each co-author assessed this publication individually and subsequently the results were compared against each other. The outcome of the exercise resulted in our template for the data collection process.

#### Social Transformation Database

We constructed a database with detailed information about the different human dimensions of the oceans and their drivers that have been documented. The database will provide a high-quality, descriptive, open-source information resource for students, lecturers, ecosystem managers and researchers.

The database provides the basis for future inclusions of case studies in order to create a repository of knowledge on this topic. We have extracted from the literature review key information on 20 the most common variables that helped to evaluate whether social transformations could be applied to marine SES (Table 1). Data variables included name of the authors; year of publication; objectives and key words of the papers; scale of the study; type of social transformation; economic sectors affected; synergies and trade-offs identified; links between habitats, CES, and human wellbeing; countries of case studies; drivers of change affecting ecosystems and their CES; among others.

**Table 1. Summary of information of social transformations (ST) extracted from each paper for the literature review.**

Field ID	Description
<b>1. Authors</b>	Name of article authors
<b>2. Year</b>	Year of publication
<b>3. Key-words</b>	Selected key words of the paper
<b>4. Objectives</b>	Specify the objectives as in the paper
<b>5. Discipline authors</b>	The main discipline of each author of the paper (e.g., ecology I biology I economics I other (specify)
<b>6. Country affiliation</b>	Country of institutional affiliation of first author
<b>7. Country study</b>	Country(ies) where the case study(ies) took place
<b>8. Type of paper</b>	Empirical I conceptual I review
<b>9. Social Transformation</b>	Yes I Not
<b>10. Type of ST</b>	Restructuring the fisheries sector   employment opportunities   changes in catches   diversification of seafood markets I Other (specify). Demersal I pelagic I crustaceans I molluscs I other (specify). Small-scale fisheries I industrial fisheries I aquaculture I canned industry
<b>11. Targeted species</b>	Local I regional I national I continental I global
<b>12. Economic sectors</b>	Introduction of new regulation I change in market demand I environmental shifts, etc.
<b>13. Scale of ST</b>	Commercial species I habitats I ecosystems I other (specify).
<b>14. Drivers of ST</b>	Food security or Nutrition I Income and employment I Security of housing and infrastructure I Leisure and recreation I Cultural heritage I Social relations I No direct impacts I Others (e.g., demography, health, education,
<b>15. Impacts on species</b>	

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<b>16. Impacts of human-well being</b>	etc.).  Months   Year   Decades   Unknown  Irreversible   difficult to reverse   easy to reverse   unknown  Field work   time series   models   literature references   Other (specify)
<b>17. Time scale of ST</b>	Speculative – Social transformation has been proposed, but little scientific evidence as yet,
<b>18. Reversibility of ST</b>	
<b>19. Sources of evidence</b>	Contested – Reasonable evidence both for and against the existence of social change,
<b>20. Confidence of evidence</b>	Well established – Wide agreement in the literature that the social transformation exist

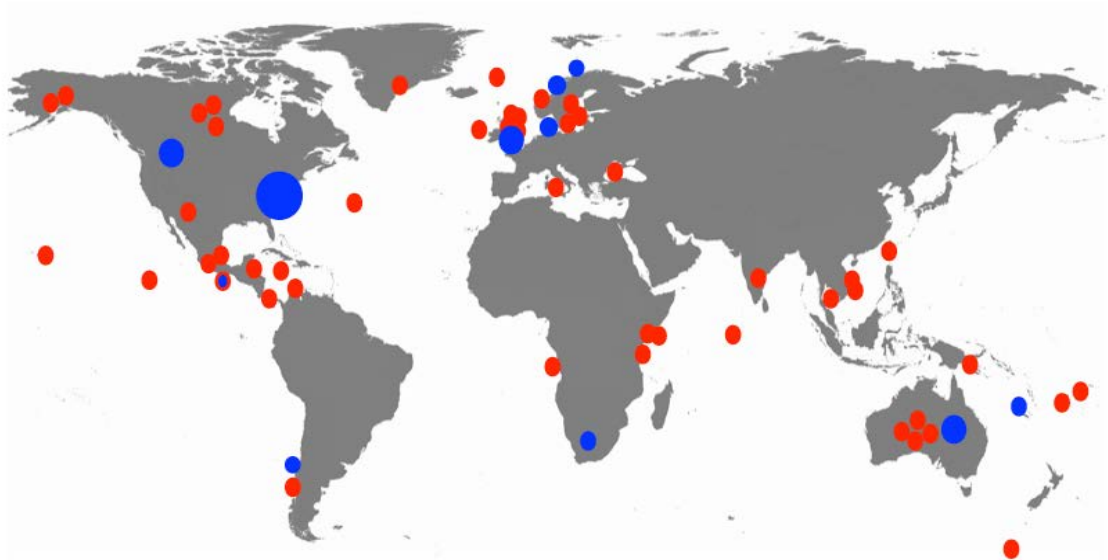
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Members of the research team created a template to collect detailed information to provide evidence for the selected case studies included in the project has been gathered by using a template developed by the research team. The detailed content of this template is included in the Supplementary Material of this progress report.

#### **Preliminary results**

##### ***Literature review***

The results of the literature review show that the topic of social adaptation, change and transformation in marine SES attracted little attention for the scientific community in the 1950–2014 period (Figure 6). Figure 6 indicates that these topics started to receive important attention only since the year 2010, when a total 10 papers have been published, while the highest number of papers (15) has been published in 2015. The results obtained from the systematic review indicate that most of the papers are review (42%) or empirical studies (41%), and only a few (17%) of them are conceptual papers.



**Figure 6. Global distribution of transformations case studies (in red) and affiliations of first author (blue).**

Given the high number of case studies we further explored the spatial scale at which these assessments were carried out. The largest percentage of the case studies was carried out either at local level (39%), followed by global (18%), regional and national scales (8% each). The geographical locations of the topics within the reviewed papers are shown on Figure 6. It is noticeable that while most of the first authors of the published papers comes from the developed world (namely Sweden, United Kingdom and the USA), the location of the case studies are equally balanced between developed and developing countries.

#### **A new conceptual framework to investigate social transformations of marine social-ecological systems**

Here we define a social transformation in marine SES as a fundamental and critical change of values, institutions and practices of a social structure at the same time. To analyse the phenomena of social transformations in the marine arena, we examine the following core elements: (1) *values*, which refers to shared ways of living and thinking that include symbols and language (verbal and non-verbal); knowledge and beliefs (what is “good” and “bad”); (2) *institutions*, which contains the diversity of laws, regulations and costumes with competence to adopt decision on marine activities, and (3) *practices*, which includes the changes experienced by different marine activities (e.g., industrial and small-scale fisheries).

As founded in the systematic review, a single or multiple factor can drive a social transformation. The capacity of a SES to minimise or absorb the impact of a single or multiple driver(s) depends on the existence of inhibiting conditions present in it, which usually act as barriers to avoid social transformations. For example, inadequacies associated with

using MPAs as a fisheries management tool can also be exacerbated by a failure to successfully manage surrounding fisheries.

However, there are also enabling conditions which facilitate the navigation towards a social transformation. Enabling conditions generally encompass a suite of governance, community and capacity-related factors that can vary over space and time and may influence the degree of success of a particular management intervention. For example, the existence of formal regulations and legal regimes, the need for a high degree of information, and national or municipal governance capacity were identified as key enabling conditions in small-scale fisheries. The schematic representation for the analysis of a transformation in marine SES is described in Figure 7.

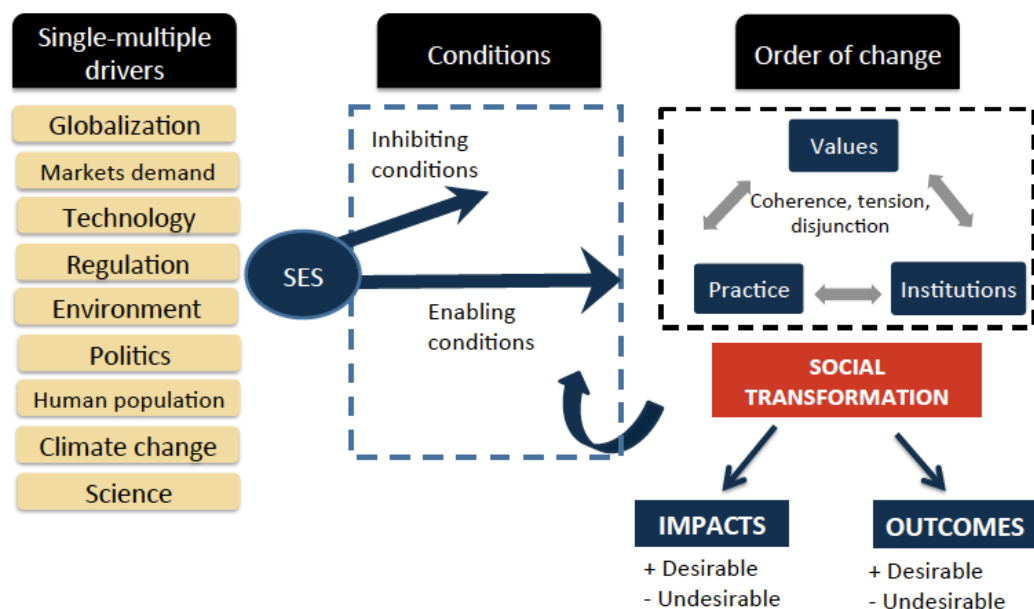


Figure 7. Conceptual framework for social transformations in marine social-ecological systems.

In addition, it has been demonstrated that a successful implementation of co-management systems around the world is highly dependent on the leadership of local and well-recognized experts in coastal communities. It is important to differentiate the concept of social transformation compared to other related social-ecological concepts such as adaptation. Adaptation reflects the capacity of a system to adjust its responses to change in external drivers and internal processes. For example, the diversification of harvested species can be an adaptive strategy developed by fishers to deal with the scarcity of fishery resources.

On the other hand, social transformation means a fundamental and critical shift in the institutional dimension and patterns of practices through time. We argue that social transformation supposes both the change of practices as well as changes in laws, regulations and customs of the social structure. For example, the creation of a new co-

management system supposes the change of laws and regulations such as the introduction of a limited entry program (institutional change) and the elaboration of exploitation plans (practices change) developed jointly by the administration and fishers. Finally, a revolution means a change that is more significant than adaptation or transformation, one that recombines existing elements of a system in radically novel ways of thinking, institutions and practices.

In using these three core elements (values, institutions and practices), we build on previous research that has demonstrated that natural and social capital and their interactions can deliver human well-being and maintain social health of SES (e.g., Chapin *et al.* 2011). These three elements provide a critical point of linkage between the social systems, and thus, if deliberate social transformations can be expected to alter a linked social system, it is these elements that are likely to be changed.

It is important to highlight that the effects of a social transformation can be positive desirable or undesirable. A desirable impact is usually conceived as a positive contribution for the welfare of people and institutions which depend on marine activities. For example, if the introduction of a co-management system leads to the reduction of poverty and inequality of small-scale fishers by improving the revenues and social benefits that ecosystem services provide. On the other hand, an undesirable impact of a social transformation would be reducing the effectiveness of a management plan if the level of compliance of fisheries laws by the fishing industry is low.

#### **Operationalizing guidelines for social transformations**

We argue that a social transformation experienced by marine SES can be triggered by a fundamental and critical change of practices and institutions of the social structure of the system. This change has different drivers and impacts at different time and spatial scales. Given that there is a wide range of drivers and impacts generating social transformations which are often difficult to systematize, we also propose a new guideline which includes a set of seven steps for analysing social transformations of marine SES:

- i ) First, describe the biophysical, social and governance boundaries of the system, which also supposed to clearly define the unit of analysis which is involved in the social transformation (e.g., a metier, a fishing fleet, a coastal community),
- ii ) Second, identify “what” (e.g., environmental shock, introduction of a new regulation such as a landing obligation, a MPA, etc.), “who” (e.g., government, fishing industry, a coastal community) drives the process of a social transformation, “why” (e.g., increasing biomass of commercial fisheries, improving compliance and monitoring of fishing activities) and “when” (e.g., year, decade, etc.) the event take place,
- iii ) Third, identify and describe the enable and inhibiting conditions which facilitate (or not) the existence of a social transformation in the system,
- iv ) Fourth, analyse the relationships (e.g., conflict, tension, disruption) between the practices, institutions and values present in the system,
- v ) Fifth, analyse the type of single or multiple factors (e.g., environmental, economic, institutional, social) driving the transformation, and the fundamental and critical impacts (desirable or undesirable) of drivers, identifying what

are the consequences for the different actors (fishers, institutions, coastal communities) of the social structure,

- vi) Sixth, depending on the availability of data, select and validate the most suitable quantitative and/or qualitative with the participation of the main stakeholders affected by the social transformation, and use social indicators to monitor the progress of the social transformation over time, and
- vii) Seventh, design and evaluate (if necessary) alternative strategies and scenarios to successfully navigate into resilient and sustainable trajectories of the social structure.

The new knowledge generated by this project contributes to: a) provide key information about the local dynamics of the marine SES currently unavailable in official databases and reports but with potential global effects on the management of marine SES, b) recognize the spatial and temporal dimensions of social transformations, c) indicate what are the adaptive strategies social actors have been developing over time, d) identify the barriers (if any) that fishers, enterprises and institutions are facing in relation to current social transformations, and f) identify the best plausible management strategies and scenarios in which they could start or continue navigating into resilient and sustainable trajectories.

#### **The Social Transformations DataBase**

The Social Transformations Database includes scientific evidence currently unavailable in official statistics and reports related to: a) Identify the main drivers (e.g., stock status, climate change, EU regulations, economic and financial crisis, seafood market changes, etc.) which generated social transformations; b) Analyse the major economic and social consequences of these transformations; c) Examine the adaptive strategies developed by marine social-ecological systems to navigate into successful transformations towards sustainability.

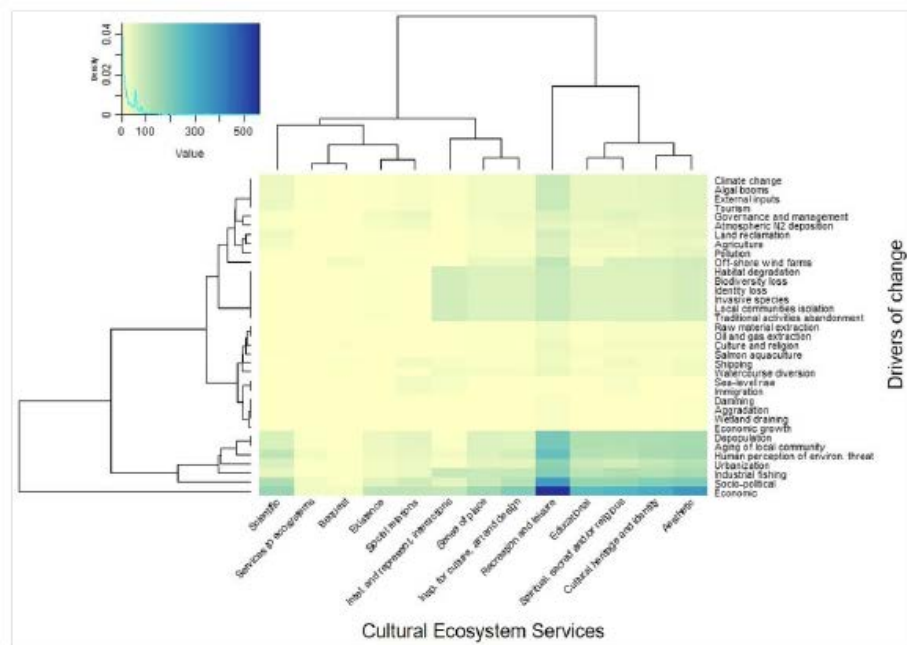
The Social Transformations DataBase provides examples of different types of transformations that have been documented in marine social-ecological systems. The database focuses specifically on fundamental and critical changes that have large impacts on marine SES. It includes several examples to illustrate the diversity of case studies in which the phenomena of social transformations can take place. These examples serve as a basis to better understand the social transformation phenomena and also to extend the use of the conceptual framework presented here for future research. We welcome contributions from the scientific community to add new examples of case studies which experienced social transformations in Europe documented.

Under this topic, WGRMES also advanced beyond the state of the art by understanding in depth the role of cultural marine and coastal ecosystem services globally. This paper *“Marine and Coastal Cultural Ecosystem Services: knowledge gaps and research priorities”* has been published in the journal *One Ecosystem* 2: e12290 in 2017.

Whereas coasts, seas, and oceans sustain a great proportion of the human population, CES provided by these ecosystems have remained largely unexplored. Therefore, our aims were (1) to analyse the state of research on marine and coastal CES, (2) to identify knowledge gaps, and (3) to identify research priorities and pinpoint the move forward. To accomplish these objectives, we did a systematic review of the scientific literature and

synthesised a subset of 72 peer-reviewed publications. Results show that research on marine and coastal CES is scarce compared to other ecosystem service categories. It is primarily focused on local and regional sociocultural or economic assessments of coastal ecosystems from Western Europe and North America. Such research bias narrows the understanding of social-ecological interactions to a western cultural setting, undermining the role of other worldviews in the understanding of a wide range of interactions between cultural practices and ecosystems worldwide.

Our literature synthesis revealed that economic drivers negatively affect the provision of practically all CES classes (Figure 8). Several publications listed this type of drivers in a general and aggregate manner, but others specified the type of economic drivers affecting CES, namely economic growth, damming, tourism, land reclamation, to name a few.



**Figure 8.** Drivers of change affecting marine and coastal CES classes. Dendrograms represent similar drivers grouped by hierarchical clustering on the Euclidean distance between the rows and columns of the matrix, according to the number of links found in the literature review.

Also, two main clusters of drivers primarily affect a set of CES composed by recreation and leisure, aesthetic amenities, cultural heritage and identity, spiritual, sacred and/or religious experiences, and educational services. The main cluster of drivers includes depopulation, aging of local community, human perception of environmental threat (public opinion about areas potentially under environmental threat such as pollution, toxins, debris, etc.), urbanization, industrial fishing, and socio-political and economic drivers. A second cluster of drivers affects primarily the same set of CES plus the group 'intellectual and representative interactions'. This cluster is composed by traditional activities abandonment, local communities' isolation, identity loss, invasive species, habitat degradation, and biodiversity loss. A common characteristic in the composition of these two clusters is a set of economic, demographic, sociocultural and ecological drivers that together negatively affect marine and coastal CES.

Additionally, we have identified clusters of co-occurring drivers of change affecting marine and coastal habitats and their CES. Our systematic review highlights knowledge gaps in: (1) the lack of integrated valuation assessments; (2) linking the contribution of CES benefits to human wellbeing; (3) assessing more subjective and intangible CES classes; (4) identifying the role of open-ocean and deep-sea areas in providing CES; and (5) understanding the role of non-natural capital in the co-production of marine and coastal CES. Research priorities should be aimed at filling these knowledge gaps. Overcoming such challenges can result in increased appreciation of marine and coastal CES, and more balanced decision-supporting mechanisms that will ultimately contribute to more sustainable interactions between humans and marine ecosystems.

### Other research and outreach activities developed by the WGRMES

During the year 2017, members of the WGRMES also developed the following outputs:

#### Participation at international scientific conferences ICES Conference

- A Theme Session at 9<sup>th</sup> ESP Conference 2017 “Ecosystem services for the eco-civilization” to be held in China on December 2017 entitled “*The role of social sciences in ecosystem services valuation*” that is co-organized by S.Villasante, S. Chen and H. Zheng.
- A Theme Session at ICES ASC Conference 2017 to be held in the USA in September 2017 entitled “*Integrated assessment of marine ecosystem services*” that is co-organized by T. Charles, M. Grazia Penino, S.Villasante and C. Pita.

#### Key publications in scientific journals

Throughout: names of WGRMES members in **bold**; students in **bold** and *italics*; international collaborators underlined.

**Garcia Rodriguez, J., Villasante S.** (2016) Disentangling seafood value chains: Tourism and the local market driving small-scale fisheries. *Marine Policy* 74: 33–42.

Li, C., Villasante, S., Xueqin, L. (2016) Resilience and thresholds in marine social- ecological systems: the case study of the Argentinean hake fishery. *Environment and Development Economics* 65:623. doi:10.1007/s10640-016-0038-y.

**Villasante, S., Pita, C., Pierce, G., Pazos Guimeráns, C., Garcia Rodriguez, J., Antelo, M., Da Rocha, JM., García Cutrín, J., Hastie, L., Sumaila, R., Coll, M.** (2016) To land or not to land: How do stakeholders perceive the zero discard policy in European small-scale fisheries? *Marine Policy* 71:166–174.

**Rivero-Rodriguez, S., Villasante, S.** 2016. What are the research priorities for marine ecosystem services? *Marine Policy* 66:104–113.

#### Reports

**Villasante, S., Guyader, O.** (2016) Social Transformation of marine social-ecological systems, ICES Science Fund Report, 15 p.

**Silva, A., Moreno, A., Riveiro, I., Santos, B., Pita, C., Garcia Rodriguez, J., Villasante, S., Pawlowski, L., Duhamel, E.** (2016) Sardine Fisheries: Resource assessment and social and economic situation, European Parliament, Directorate-General for Internal Policies Policy Department B: Structural and Cohesion Policies, Brussels, 69 p.

Villasante, S., Pazos Guimeráns, C., *Garcia Rodrigues, J.*, Antelo, M., *Rivero Rodríguez, S.*, Da Rocha, JM., *Coll, M.*, *Pita, C.*, *Pierce, G.*, *Hastie, L.*, *Sumaila, R.* (2016) Small-scale fisheries and the zero discard target, European Parliament, Directorate-General for Internal Policies Policy Department B: Structural and Cohesion Policies, Brussels, 73 p.

### Special Issues

- Organization of a Special Issue (SI) “*Managing marine ecosystem services under the Anthropocene*” in the Journal Ecology and Society, leaded by S. Villasante, that will be published during the year 2018.
- Organization of a Special Issue (SI) “*Operationalizing marine and coastal ecosystem services*” in the Journal International Journal of Biodiversity, leaded by J. Garcia Rodrigues, S. Villasante, C. Kermagoret, C. Lique, N. Beaumont, V. Drakou, what will be published during the year 2017.

### Advisory outcomes

Several members of the WGRMES are part of a new Latin American scientific network named “[ECOMAR - Assessment and Monitoring of Marine-Coastal Ecosystem Services](#)” founded by CYTED (Iberoamerican Program of Science and Technology for Development) and leaded by S. Villasante. The main objective of this net is to promote scientific and technical cooperation related to protected natural areas for improving the management of these areas as well as the generation of strategic alliances and coordination and dissemination mechanisms of successful management models based on evaluation of marine-coastal ecosystem services in a context of global change. Several case studies in Spain and Portugal has been already selected and ES provided will be analysed; management recommendations will be proposed in collaboration with the management administrations of these areas.

Members of the WGRMES met in 2016 with the regional government of Galicia (Xunta de Galicia) to jointly develop a Regional Strategy of Marine Ecosystem Services in Galicia (NW Spain). The development of the document and the strategy is currently paused due to political changes in the regional government. We are exploring possible funding opportunities to resume the work plan and re-engaging the public administration.

In addition, the Fishing Guilds’ Galician Federation (“Federación Gallega de Cofradías de Pescadores”) created a new Working Group on Small-Scale Fisheries in which the role of marine ecosystem services will be key. The WG will be formally presented to the society in Sept 2017 with the organization of a workshop about the current problems and challenges of small-scale fisheries in Galicia (NW Spain). Members of the WGRMES are involved in this group.

### Methodological developments

#### Datasets

The WGRMES has started to develop two databases for ICES with detailed information based on the ToRs. The *Cultural Marine Ecosystem Services Dataset* includes information about cultural marine ES globally. This research is the first contribution directly related to cultural services in the marine science. This work includes a new CES framework for practical application in the marine and coastal environment by managers and decision

makers. In addition, the dataset provides an overview of the state of the art of marine and coastal CES research worldwide, it identifies key factors/variables to take into account in marine and coastal CES assessments, and it also analyses the main drivers of change in marine and coastal CES potentials, flows, and demands.

In addition, WGRMES also advanced in the development of a Social Transformation Database. The *Social Transformation Dataset* provides a high-quality, descriptive, open-source information resource for the scientific community, ecosystem managers and the sectors related to the marine ecosystem (i.e. fisheries, aquaculture and canning industry). This database provides the basis for future inclusions of case studies in order to create a repository of knowledge on this topic. The dataset includes key information on 20 of the most common attributes that helped to evaluate whether social transformations can be applied to marine SES.

Preliminary results of the Social Transformation Dataset have been presented at the CES/PICES Symposium on "Understanding marine socio-ecological systems: including the human dimension in Integrated Ecosystem Assessments" held in Brest (France) in May 30<sup>th</sup> - June 3<sup>rd</sup>, 2016.

#### **Further progress report on ToRs and workplan**

For the progress by ToRs, a detailed description of the tasks developed during 2016 will be included in the full interim report. The WGRMES decided to advance in the following actions related to each of the topics considered key for the ToRs.

Topic 1: Marine ES under the Blue Growth Agenda and socioeconomics of marine ES

Two papers will be developing during the year 2017-2018:

Paper #1: Harmonizing the triad: Blue Growth, environmental pressures and human wellbeing (led by A. Lillebo)

Paper #2: Fisheries in the Blue Growth Agenda (Position paper co-led by G.Macho and S.Villasante)

Topic 2: Synergies and trade-offs between marine ecosystem services

Paper #3: Global review of co-production of marine ES (led by S.Villasante and G.Macho), in collaboration with 13 international scientists from the Future Earth Program.

Paper #4: Marine ecosystem services, food security and human health (led by S.Villasante)

Topic 3: Small-scale fisheries and marine ecosystem services

Paper #5: Global analysis of marine ES provided by industrial vs small-scale fisheries (led by C.Pita)

Paper #6: Key drivers for resilient small-scale fisheries (led by C.Montero)

Topic 4: Social transformations of marine social-ecological systems

Paper #7: Tipping points and transformative changes of marine ES (led by S.Villasante, G. Macho)

In order to exchange scientific information and increase the cooperation between ICES WGs, the WGRMES also discussed potential topics to enhance cooperation with the WGSEDA, WGEAWESS and WGCOMEDA around the economic, social and governance dimensions of the Marine Strategy Framework Directive, which will be further developed during the course of 2017.

### **Funding**

Members of the WGRMES decided to promote initiatives to get funds for the mobility of the members as well as to develop specific tasks of the ToRs. The WGRMES agreed to investigate possibilities to participate in the following actions:

- H2020 Calls:
  - H2020-SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy: LC-BG-03-2018 Sustainable harvesting of marine biological resources & LC-BG-05-2020 Fisheries in full ecosystem context.
  - H2020-SC5: Climate action, environment, resource efficiency and raw materials: LC-CLA-06-2019: Inter-relations between climate change, biodiversity and ecosystem services
- ERC-Consolidator Grant (Feb, 2018)
- COST Action (Dic, 2017)
- UNESCO Chair (Dic, 2017)
- Other potential calls: INTERREG (POCTEP- Spain & Portugal, SUDOE - Spain, Portugal & South France, Interreg-Atlantic Area and Interreg-Europe), Science for Nature and People Partnership (SNAPP)

### **Next meeting**

Provided WGRMES next term is approved, the group aims to meet again in Stockholm, Sweden, in June 2018. A report on the activities of WGRMES in 2018 including future activities will be presented there.

## Annex 7: Agenda

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**Location:** Consejo Superior de Investigaciones Científicas (CSIC). Instituto de Investigaciones Marinas - C/ Eduardo Cabello Nº 6. CP 36208. Vigo (Pontevedra).

### **Day 1. Wednesday 12/07/2017**

9.00. Arrival of participants

9.30 – 10.00. Welcome, practical information, and presentation of participants.

10.00 – 10.15. Revision of the agenda and objectives for the present year (Sebastian Villasante, Gonzalo Macho).

10.15 – 10.30. Updated of description of current and new specific topics, and presentations of the WG (Sebastian Villasante, Gonzalo Macho).

- Topic 1: The Blue growth agenda and marine-coastal ecosystem services
- Topic 2: Small scale fisheries and marine-coastal ecosystem services
- Topic 3: Synergies and trade-offs between marine-coastal ecosystem services
- Topic 4: Social transformations of marine-coastal ecosystem services

10.30 – 11.00. Coffee break

11.00 – 11.15. Introduction to focus discussion on Topic 1 on Blue Growth (Sebastian Villasante).

11.15 – 13.00. Discussions on the topic 1: summary of agreements, work to be developed, timing and definition of tasks (Drafting paper 1)

Presentation: Ana Lillebo. University of Aveiro.

Presentation: Elena Ojea. University of Vigo.

13.00 – 14.00. Group lunch (Liceo Marítimo Bouzas <http://liceobouzas.com/contacto/>) and Group photo

14.00 – 14.15. Introduction to focused discussion on Topic 2 Small-scale fisheries and marine-coastal ecosystem services (Gonzalo Macho).

14.15 – 16.00. Discussions on the topic 2: summary of agreements, work to be developed, timing and definition of tasks (Drafting paper 2)

Presentation: Cristina Pita. University of Aveiro.

Presentation: Carlos Montero. Marine Stewardship Council.

16.00 – 16:30. Closing day discussion: conclusions, links and next steps.

### **Day 2. Thursday 13/07/2017**

9.00 – 9.15. Introduction to focused discussion on Topic 3: Synergies and trade-offs between marine-coastal ecosystem services (S.Villasante).

9.15– 11.00. Discussions on the Topic 3: summary of agreements, work to be developed, timing and definition of tasks (Drafting paper 3).

Presentation: A. Belgrano. Swedish University of Agricultural Sciences.

11.00 – 11.30. Coffee break

11.30 – 11.45. Introduction to focused discussion on Topic 4: Social transformation of marine socio-ecological systems (S. Villasante).

11.45 – 13.00. Discussions on the Topic 4: summary of agreements, work to be developed, timing and definition of tasks (Drafting paper 4).

13.00 – 14.00. Lunch Liceo Marítimo Bouzas (<http://liceobouzas.com/contacto/>) and group photo.

14.00 – 15.30. New TORs of the ICES WGRMES. Funding opportunities: H2020, Cost Action, CYTED, etc.

16.00- 17.00. Closing day discussion: conclusions, links and next steps.

### **Day 3. Friday 15/06**

Social event. Visit to Port of Vigo.