

TRANS-CHANNEL FORUM PROCEEDINGS  
"SCIENCE AND GOVERNANCE OF  
THE CHANNEL MARINE ECOSYSTEM"

English

2<sup>nd</sup> and 3<sup>rd</sup> July 2014  
Caen, France



Promoting Effective Governance  
of the Channel Ecosystem

Promouvoir une gouvernance efficace  
de l'écosystème de la Manche



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## PEGASEAS partners and their logos



## PEGASEAS projects and their logos



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# PEGASEAS PROJECT



Promoting Effective Governance  
of the Channel Ecosystem

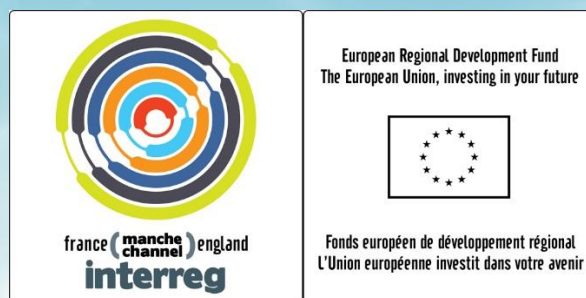
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### “SCIENCE AND GOVERNANCE OF THE CHANNEL MARINE ECOSYSTEM”

2<sup>nd</sup> and 3<sup>rd</sup> July 2014

University of Caen Basse-Normandie



Organisation committee



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## Simplified programme of the Forum

Wednesday 2<sup>nd</sup> July 2014

- Sineux Pierre, President of the University of Caen Basse-Normandie – Welcome talk.
- Fletcher Steve - Presentation of the project PEGASEAS.
- Robin Jean-Paul, Loughran Deborah and Petit Laetitia - Objectives, Forum program and presentation of the compendium.

### **Session 1 - The Chanel ecosystem: actual state, tools and results - Chairman: Robin Jean-Paul**

1. Dauvin Jean-Claude - Guest speaker - The Channel: an example of megatidal anthroposystem functioning. p.9
2. Artigas Luis Felipe - Towards the implementation of semi-automated techniques for phytoplankton monitoring in Channel waters. p.10
3. Salaün Yannick - The management of marina sediments: from the sociologic study to the communication action. p.11
4. Pade Nicolas G. - Electronic tagging and tracking of common cuttlefish (*Sepia officinalis*) in the Western English Channel. p.12
5. Foveau Aurélie - Benthic sensitive habitat mapping: a new tool for ecosystem management? p.13
6. Niquil Nathalie - Ongoing research on ecosystem health indicators of food webs in the MSFD context. p.14

### **Session 2 - The present and future challenges in the Channel: Governance researches - Chairman: McQuatters-Gollop Abigail**

7. Prouzet Patrick - Guest speaker - Impact of global changes on living aquatic resources: some reflections. p.16
8. Molfese Carlotta - Overfishing and the replacement of demersal finfish by shellfish: an example from the English Channel. p.17
9. McQuatters-Gollop Abigail - Challenges for developing policy indicators against a background of macroecological change. p.20
10. Sewell Jack - Through the portal - improving the flow of information on non-native marine species in Great Britain. p.21

**Parallel workshops on the themes:**

- Marine ecosystems dynamics and management - Facilitator: Dauvin Jean-Claude, Scribe: Auber Arnaud
- Pressure and activity on the marine environment - Facilitator: Claquin Pascal, Scribe: McQuatters-Gollop Abigail
- Governance at multiple scales in the Channel - Facilitator: Carpenter Angela, Scribe: Evariste Emmanuelle
- Communication and stakeholder involvement - Facilitator: Parr Jon, Scribe: Skinner Jennifer
- Management and use of information and data - Facilitator: Blumerel Pauline, Scribe: Thenail Bruno

**Poster session with more than 30 posters**

Thursday 3<sup>rd</sup> July 2014

**Session 3 - Toward integrated management of the Channel: what are the future research and actions in order to improve the Channel governance? - Chairman: Thenail Bruno**

- 11. Tasker Mark - Guest speaker - ICES advice on good ecological status of marine ecosystem: management of international pressures on a common ecosystem. p.22
- 12. Thiebaut Eric - Long-term observation of the environment: which inputs and lacks for an improved management of the coastal areas. p.23
- 13. Aulert Christophe - Toward an observatory of “top predators” for the marine sub-region of the Channel-North Sea. p.24
- 14. Picault David - Coastal fishing and governance in France. p.25
- 15. Mongruel Rémi - Building an operational framework for marine ecosystem services assessment: insights from the VALMER project. p.26
- 16. Thenail Bruno - Implementing an integrated maritime strategy for the Channel region. p.27
- 17. Glenn Helen - Marine governance and policy - The Channel Seas. p.28

**Session: Discussion - Round Table - Chairman: Fletcher Steve**

- Workshop summaries
- Stuart Hughes, Councilor of Devon County Council and of the Local Government Association - Channel governance - Perspectives from United Kingdom.
- Marlot Hélène - Overviews of the program of co-operation INTERREG France (Channel) - England
- Round table and conclusions of the forum.

## PEGASEAS Project, The 2<sup>nd</sup> forum and its context

PEGASEAS project is a capitalisation project funded by the European programme INTERREG IV A France (Channel)-England. Its aim is to promote an effective governance of the Channel ecosystem through the identification and capitalization of common key elements. This trans-Channel project between France and England is led by Plymouth University and involved several partners such as local and regional authorities, governmental agencies, research institutes and universities. It brought together eleven projects from INTERREG IV A: CAMIS, ChannelIS, CHARM 3, CRESH, LiCCo, Marinexus, MERiFIC, OFELIA, PANACHE, SETARMS and VALMER (Figure 1).



**Figure 1: Map showing the regions and INTERREG IV A projects involved in PEGASEAS project.**

The studied fields in PEGASEAS are diversified. They are going from the protection of the biodiversity to the trans-boundary cooperation tools, including ecosystem management methods. They integrate scientific data and supply priorities to stakeholders and citizens for the governance of the Channel marine ecosystems. From the key element analysis of each project included in PEGASEAS (and also some others outside of the project), the PEGASEAS partners produced a compendium<sup>1</sup> presented during the Forum “Science and Governance of the Channel Marine Ecosystem” held at the University of Caen Basse-Normandie, early July 2014. This complete analysis of determining elements for an effective marine governance of the Channel could contribute to the improvement of the governance through described tools and based scientific conclusions.

In the context of the PEGASEAS project, three forums were organized in 2014, succeeding to the four trans-Channel forums organized by the project CAMIS on the governance theme since 2009 (Figure 2). The PEGASEAS forums aim to gather together the decision-makers, practitioners, scientists and stakeholders to improve the governance of the marine ecosystem of the Channel combining the

<sup>1</sup> Petit L and Carpenter A (2014) Towards better governance of the Channel ecosystem. Report from the Promoting Effective Governance of the channel Ecosystem Project; [www.pegaseas.eu](http://www.pegaseas.eu).

environmental, economic and social sciences. The Forum “Science and Governance of the Channel Marine Ecosystem” was the second forum organized by PEGASEAS and was held on the 2<sup>nd</sup> and 3<sup>rd</sup> July 2014 in Caen (France). This event, organized by the University of Caen Basse-Normandie, IFREMER Boulogne-sur-Mer, the Devon County Council and the *Région Haute-Normandie*, focused on integrating marine science into the governance of the Channel ecosystem.



Figure 2: Trans-Channel forums on the governance theme.

This Forum has given the opportunity to the scientists to contribute to trans-disciplinary analyses of the Channel marine ecosystem by sharing their results and conclusions, but also to the stakeholders and policy-makers to hear about recent research into the Channel marine ecosystem and consider how this can support the governance of the Channel. The production of this forum’s proceedings allows us to share the knowledge, the observations and the discussion that occurred during the Forum.

The forums organized by the PEGASEAS project were set up to discuss and debate on the governance of Channel ecosystem and its issues. As explained by the Figure 3, they also allowed to complete the compendium produced by the PEGASEAS partners and to highlight the important themes that should be studied in the next INTERREG programme, INTERREG V. At the end, it is expected that this approach will help to improve the governance of the Channel marine ecosystem at the French, English and also European scale.

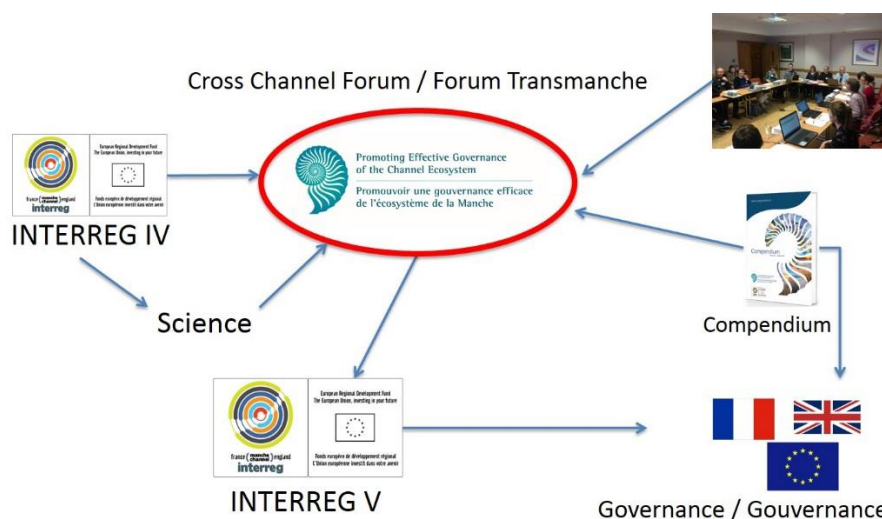


Figure 3: Links between PEGASEAS, INTERREG programmes and the governance of the marine ecosystem.



## Editorial from Steve Fletcher<sup>2</sup>, leader of the PEGASEAS project

The Channel is an important social, economic and ecological resource for both France and the United Kingdom. Its history helps to shape our identities, its natural resources support our economies, and its role as a transport link is critical to global trade. In order to secure these benefits on an ongoing basis, it is vital that we have a clear understanding of the Channel ecosystem and an effective mechanism to govern its use and ensure its protection.

A key challenge is that at present, the Channel is not governed as a single system, but as two independent areas divided by national borders. This puts at risk the integrity of the Channel ecosystem which requires holistic and ecosystem based governance. Through the INTERREG IV A capitalisation project ‘Promoting Effective Governance of the Channel Ecosystem’ (PEGASEAS) these matters have been examined further and recommendations generated to support improved governance of the Channel.

Of central importance to effective Channel governance is high quality Channel science. A two-day conference organised through the PEGASEAS project provided an overview of our current understanding of Channel science. This document summarises that event and therefore reflects closely our current understanding of the Channel ecosystem and its governance. In the absence of an understanding of the Channel ecosystem, its governance is unlikely to be effective, therefore this document makes an important contribution to the debate about the future of the Channel.

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<sup>2</sup> Director of Centre for Marine and Coastal Policy Research, Plymouth University, UK

## **Editorial from the President of the University of Caen Basse-Normandie, Pierre Sineux**

The University of Caen Basse-Normandie (UNICAEN) was happy to welcome this forum and all its participants that came from various regions, both sides of the English Channel. The relationship between UNICAEN and England is old, the University of Caen founded in 1432 by Henry VI of England, was destroyed during the 2<sup>nd</sup> world war. Most of the buildings were rebuilt and opened in 1957; they are now ranked as “historical monuments”.

This forum took place thanks to the commitment of two university components in the PEGASEAS project, two joints research centres: UMR BOREA (*Biologie des organismes et des écosystèmes aquatiques*, i.e. Biology of organisms and aquatic ecosystems) and UMR M2C (*Morphodynamique continentale et côtière*, i.e. Continental and coast morphodynamic).

Project such as PEGASEAS allow to develop relationship with England and to strengthen the collaboration between universities and institutes from both sides of the English Channel.

Apart from the trans-Channel relationships, this project shows the importance of the research and the education around the littoral and sea issues. The UNICAEN is strongly involved in research and innovation in the renewable marine energies and the environmental issues. The University interest for the marine environment is also visible through its support to the marine station of Luc-sur-Mer (*Centre de recherché en environnement côtier*, i.e. Centre of research in coastal environment).

Sharing your knowledge, your research developments and your practices in the different and complementary scientific areas is important. All these actions engage the present and will advance the innovations that will improve the Channel marine ecosystem future.

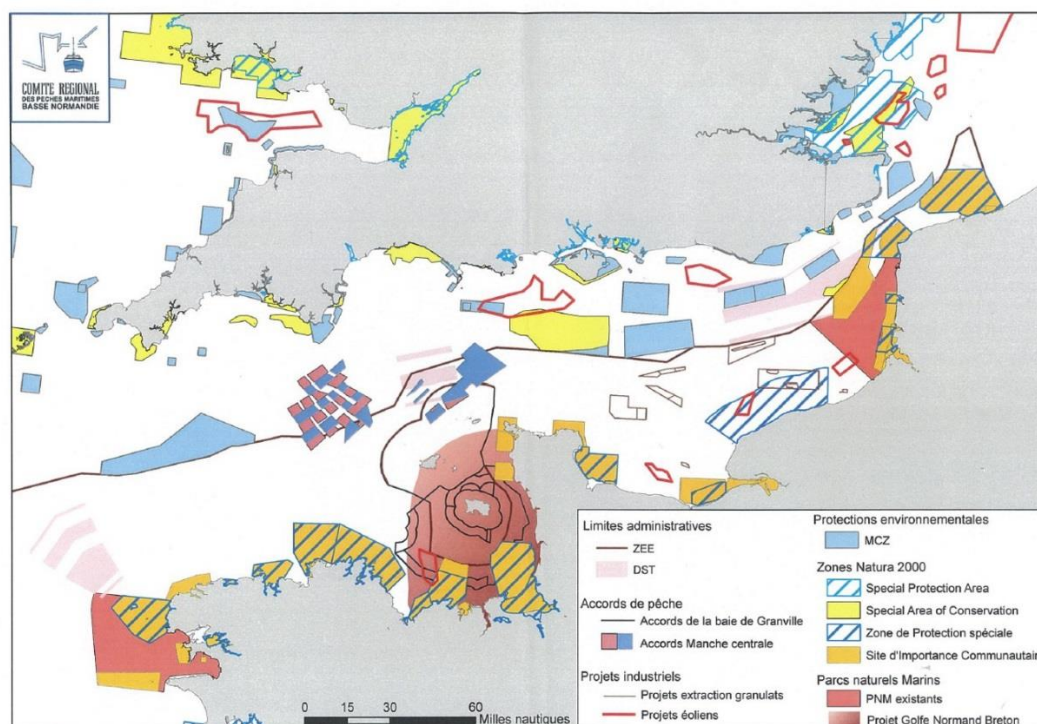
## Abstracts of the oral presentations

### Session 1 – The Channel ecosystem: actual state, tools and results

#### 1. The Channel: an example of megatidal anthroposystem functioning.

Dauvin Jean-Claude<sup>3</sup>, Marshall Paul, Lafite Robert

Abstract: The Channel, an epicontinental sea with strong tides, is the place of numerous human activities: transport, fishing, dredging sediments, installation of windmill and marine current power and aggregate extraction. These anthropogenic pressures, in a global changes context, lead to a degradation of the marine ecosystem quality, especially in the Bay of Seine where numerous activities are be superimposed. In parallel, there is a will from France and UK to develop a network of protected marine areas. Impact studies that are local and within a limited time scale have until recently been realized on all the new marine sectors without link between them. During the last decade, different scientific, interdisciplinary and cross-sectoral programs have been organized at a trans-boundary (CHARM, VECTORS...) and national with the whole and part of the Channel (PNEC, LITEAU...). Only an integration of the knowledge will allow us to take into account and analyze the numerous interactions existing between the cumulated anthropogenic effects of the anthroposystem (Figure 4). The cumulated effects at a long term (> 30 years, length of the concession for the dredging sediments, windmill and aggregate) are not sufficiently known to evaluate the effects of the whole human activities and to plan them into a dynamic system evolving under the effects of climatic changes. It is needed to test if the existing tools (food web and ecosystemic planning models) are accurate and efficient at the spatio-temporal scale of the Channel.



**Figure 4: Map of cumulated impacts and interest conflicts.** Used with the agreement of the president of the *Comité Régional des Pêches de Basse-Normandie*. @INPN, AAMP, JNCC, Finding Sanctuary, 2011.

<sup>3</sup> Université de Caen Basse-Normandie, M2C ; jean-claude.dauvin@unicaen.fr

## 2. Towards the implementation of semi-automated techniques for phytoplankton monitoring in Channel waters.

Artigas Luis Felipe<sup>4</sup>, Ali N., Alvain S., Belin C., Bonato S., Broutin M., Clauquin P., Courcot L., Chicheportiche J., Créach V., Degros N., Gailhard-Rocher I., Gómez F., Grosjean P., Guiselin N., Guérin L., Hébert P.-A., Hamad D., Houliez E., Lampert L., Lefèbvre A., Lizon F., Mériaux X., Poisson-Caillault E., Owen K., Rijkeboer M., Rombouts I., Rousseeuw K., Rutten T., Simon N., Thyssen M., Veen A., Wacquet G.

Abstract: Phytoplankton composition and dynamics sustain aquatic marine resources, reflect the environmental status of marine waters and can be responsible for harmful events with consequences in socio-economic issues and human health. Moreover, phytoplankton represents a biological component of quality of marine pelagic ecosystems indicators, in the frame of European directives or conventions, as the Water Framework directive, the Marine Strategy Framework Directive and OSPAR. However, current methodologies and monitoring practices are not equipped to deal with fast changes in phytoplankton composition, spatial monitoring coverage is rather scarce, and the analysis mostly targets only the bigger fraction of phytoplankton. In order to accurately understand phytoplankton dynamics in aquatic systems and to detect short term changes in phytoplankton biomass and composition, there is a need for innovative, robust and reproducible monitoring procedures that could be applied at high frequency. Amongst other implemented projects in recent years, within a cross-border effective work, the INTERREG IV A “2 Seas” DYMAPHY project (Development of a DYNAMIC observation system for the assessment of MARine water quality, based on PHYtoplankton analysis), explored and combined innovative semi-automated techniques, in order to propose operational procedures and greater automation in data analysis for monitoring phytoplankton, at high spatial and temporal resolution. This approach was tested in international cruises as well as in current monitoring stations in different coastal and marine ecosystems of the Region. A discussion is carried out on the effective implementation of innovative semi-automated methodologies for studying phytoplankton, in routine monitoring of Channel coastal and marine systems.

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<sup>4</sup> Université du Littoral Côte d’Opale, MREN, CNRS UMR 8187 LOG ; Felipe.Artigas@univ-littoral.fr

### **3. The management of marina sediments: from the sociologic study to the communication action.**

Salaün Yannick<sup>5</sup>, Goas Patrick

Abstract: The management of port sediments places ports at the centre of economic and environmental issues. The sustainability of their business depends upon it. In addition, the scale of sediment management is above that than the port itself. These actions are, however, poorly understood by the general public as they require an understanding of technical, legal and environmental issues that they are unfamiliar with. The question is “What is the public’s knowledge of dredging?” The *Association des Ports Locaux de la Manche* has investigated this during the European project SETARMS and the results of that study were used to develop communication tools which can be used to achieve a greater understanding of this theme by the general public.

The sociologic study conducted under SETARMS identified the need to explain why there has been an increase in dredging activities in some ports. This includes what is happening with the sediments, and what are the ecological impacts of their removal, for example. The study highlighted the knowledge (or the lack of knowledge) of general public on the management of harbour sediments and identified question that are most frequently asked by the public. The port authorities now are trying to answer to all the questions.

A concrete action has been organized within the PEGASEAS cluster to make the information accessible and understandable to a range of audience. This action will thus avoid unfounded statements. It should also enable managers to explain those decisions to the general public in a way that leaves no room for doubt about the necessity for action. In conclusion, it is recommended that port authorities put in place mobile temporary exhibitions to present information on sediment management at a wide scale and accessible to the general public of the Channel.

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<sup>5</sup> Association des Ports Locaux de la Manche ; salaunyannick@cg22.fr

#### 4. Electronic tagging and tracking of common cuttlefish (*Sepia officinalis*) in the Western English Channel.

Nicolas Pade<sup>6</sup>, Victoria Wearmouth, Stephen Cotterell, Nicolas Humphries, David W. Sims

Abstract: Global landings of cephalopods (cuttlefish, squid and octopus) have increased dramatically over the last 50 years. However, for the English Channel cuttlefish (*Sepia officinalis*) fishery there is currently no directed management, which may be particularly problematic because cuttlefish are targeted both on their coastal spawning grounds in their pre-adult stage and in offshore, deep-water sites. Hence, as the cephalopod fishery in this area is rapidly expanding there is a distinct need to know the locations and scale of annual movements. To determine the short and longer term movements we tagged 100 cuttlefish with data storage tags (DSTs) in summer 2012 off Plymouth, UK. New methods for electronic tag attachment to cuttlefish were developed during the project and tags were returned via the commercial fishery when cuttlefish were captured in gear, or when found washed ashore by the public (Figure 5). Tags recorded water depth and temperature, allowing reconstruction of horizontal movements of individual cuttlefish using a tidal geolocation algorithm, and the vertical movements were analysed. A total of 11 tags (11% of those deployed) were returned. There was evidence for sex differences in movements and behaviour, with pronounced diel vertical movements. Strikingly, significant proportions of a day were spent within the water column and near the sea surface, mostly at night. Deeper water habitats were selected as summer progressed into autumn. Our results highlight the potential of electronic tagging methods on cuttlefish as tools to aid conservation and management of this important commercial fishery species in the future.



Figure 5: Electronic tag placed on *Sepia officinalis*<sup>7</sup>. @MBA

<sup>6</sup> Marine Biological Association ; nipa@mba.ac.uk

<sup>7</sup> V.J. Wearmouth *et al.* (2013) A method for long-term tagging and tracking of juvenile and adult European common cuttlefish *Sepia officinalis*. *J. Exp. Mar. Biol. Ecol.* 447, 147-155.

## 5. Benthic sensitive habitat mapping: a new tool for ecosystem management?

Foveau Aurélie<sup>8</sup>, Vaz Sandrine, Desroy Nicolas, Kostylev Vladimir E., Dauvin Jean-Claude, Carpentier André

Abstract: The multidisciplinary integrated approach of the INTERREG CHARM project (CHannel integrated Approach for marine Resource Management), between France and England, offers decision makers a status report of the English Channel ecosystem and a range of tools based on scientific knowledge for the sustainable management of living marine resources. The English Channel supports a large number of economically significant human activities, such as maritime traffic, fisheries, exploitation of marine resources or mineral resources, wind farms. Due to its environmental characteristics, the English Channel is indeed a crucial area for the life cycle of many marine species: it supports important spawning and nursery grounds, as well as being a significant migration channel between the Atlantic and the North Sea. Some of the marine habitats and living resources in this area play a key environmental role. One of the actions of CHARM project phase III was to describe the structure, composition and distribution of benthic invertebrates in this area. The benthos is a biological compartment of the ecosystem susceptible to be adversely affected by several human activities and may serve as accurate indicators of benthic habitat quality status and sensitivity (Figure 6). The aim of the present study is to draw a benthic sensitive habitat map, based on the Kostylev approach and to complete it with a functional approach. This kind of information may be relevant to both mitigate potential impacts of present human activities and plan future activities in this area. It may also prove useful to better understand the factors affecting the distribution of fishes and predict their evolution.

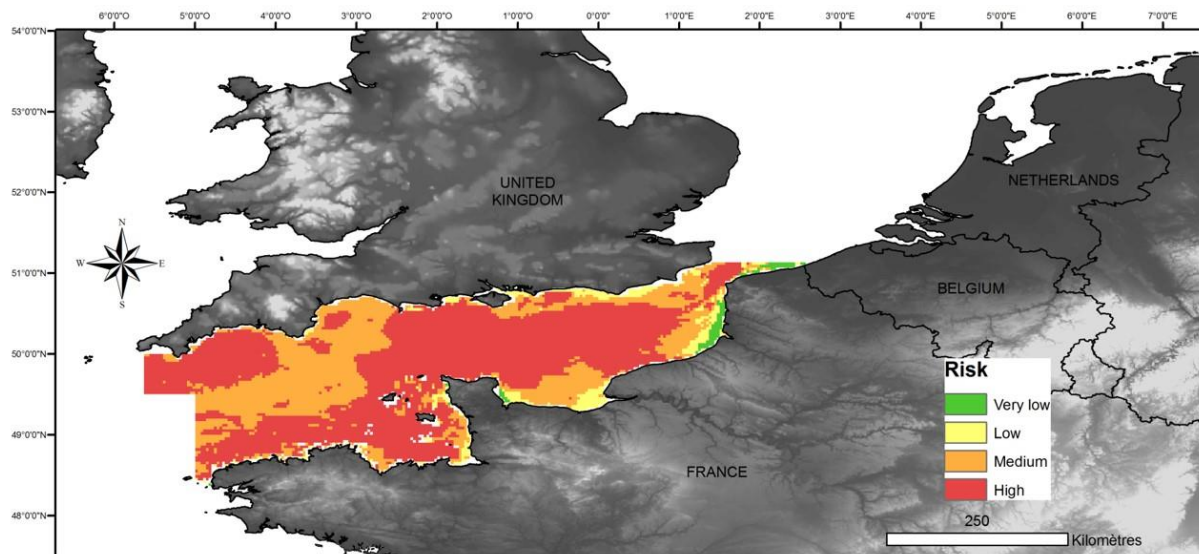


Figure 6: Map showing the risk areas of the Channel. @Foveau A.

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## 6. Ongoing research on ecosystem health indicators for food webs in the MSFD context.

Niquil Nathalie<sup>9</sup>, Le Loc’h F., Tecchio S., Chaalali A., Vouriot P., Mialet B., Fizzala X., Féral J.-P., Lamare S., Dauvin J.-C., Safi G.

Abstract: The Marine Strategy Framework Directive “...aims to achieve Good Environmental Status of the EU's marine waters by 2020 and to protect the resource....” This Directive is based on marine regions and relies on Regional Sea Conventions to define a list of common indicators and a shared monitoring strategy between member states. The development of ecosystem health indicators for characterizing biodiversity and more particularly the functioning of food webs is presently central in ecological research, because of the law context.

Our work in this subject is realized in the framework of two research projects and one convention between the National Center for Scientific Research (CNRS) and the French Ministry of Ecology, Sustainable Development and Energy (MEDDE). The first project is financed by the European Union and is called DEVOTES (DEVELOPMENT Of innovative TOOLS for understanding marine biodiversity and assessing good Environmental Status). Its objectives are 1) to improve understanding of human activities impacts and variations due to climate change on marine biodiversity and 2) to test the indicators proposed by the European Commission, and develop new ones for assessment at species, habitats and ecosystems level, for the status classification of marine waters.

The second project is named ANTROPOSEINE (Trophic Structure Analysis of the Seine Estuary and Contribution of its different Habitats). It relies on numerical methods for analyzing trophic networks that allows the integration of the different populations and guilds composing the ecosystem into a synthetic scheme. The project applies these numerical tools on the Seine estuary and bay in order to promote an integrative approach, based on the ecosystem functioning and to characterize: 1) the contribution of the different zones and habitats to the carrying capacity of this ecosystem, 2) the ecosystem health status, and 3) its dynamics.

Finally, in the context of the CNRS-MEDDE convention, a work is in progress on an indicator named “Marine Trophic Index” (MTI). MTI is the mean trophic level (TL) of marine predators, beyond a certain threshold. To use this indicator, methodological tests are needed to choose the most suited TL threshold (i.e. 2, 3, 3.25 and 3.5) to scientific surveys.

The work done on the English Channel area concerns the OSPAR, the regional sea convention working towards the protection of the marine environment of the North-East Atlantic. It is presently building a common list of indicators for MSFD implementation. Within the OSPAR Inter-sessional Correspondence Group on Biodiversity Monitoring and Assessment (ICG COBAM), the food-web expert group has proposed 9 indicators. These 9 indicators are presented in Figure 7. Different studies are presently being developed for testing these indicators in different OSPAR zones in connexion with the members of the Food Web Expert group. The priority for this group was to propose as well already operational indicators as new indicators under development, to promote indicators based on energy and matter flows and processes, and finally to take into account all components of the marine ecosystems. On this aspect, an important effort is positioned on the development of plankton indicators but the benthos remains poorly described with the proposed indicators.

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<sup>9</sup> Université de Caen Basse-Normandie, UMR BOREA ; nathalie.niquil@unicaen.fr



Among these proposed indicators, several aim at developing a holistic and functional view of the ecosystem. The indices derived from Ecological Network Analysis (i.e. recycling, omnivory, specialisation or redundancy of the flows) are based on ecosystem models. Ongoing studies are led by CNRS / Caen University. Present and future applications concern the dynamic of the Seine estuary and bay food web and the study of the environmental impact of the building and exploitation of offshore windmills and other Marine Renewable Energy devices.

| FOOD WEBS code   | Indicators   | Leading      | Status                                 |
|------------------|--|--------------|--|
| <b>FW1 (B3)</b>  | Reproductive success of marine birds in relation to food availability  | UK           | Candidate                              |
| <b>FW2</b>       | Production of phytoplankton  | FR           | Candidate                              |
| <b>FW3 (FC2)</b> | Size composition in fish communities (LFI)   | UK – NL      | <b>Common</b>                          |
| <b>FW4</b>       | Changes in average trophic level of marine predators (cf MTI)  | FR - ES      | <b>Common (under validation)</b>       |
| <b>FW5 (PH1)</b> | Change of plankton functional types (life form) index Ratio between: Gelatinous zooplankton & Fish larvae, Copepods & Phytoplankton; Holoplankton & Meroplankton | UK           | <b>Candidate</b><br><b>PRIORITIZED</b> |
| <b>FW6</b>       | Biomass, species composition and spatial distribution of zooplankton   | SE           | Candidate                              |
| <b>FW7</b>       | Biomass and abundance of functional groups   | UK – DE – ES | Candidate                              |
| <b>FW8</b>       | Changes in the distribution of biomass and species over trophic levels and body size   | FR – DE - UK | Candidate                              |
| <b>FW9</b>       | Ecological Network Analysis indicator (e.g. trophic efficiency, flow diversity)  | FR – DE - UK | Candidate                              |

**Figure 7: Indicators of food-web health, in the context of the Marine Strategy Framework Directive, proposed by the expert group “Food Web” of the OSPAR Convention (Regional Seas Convention for North East Atlantic) - Intersessional Correspondence Group on Biodiversity Monitoring and Assessment, for the list of common indicators shared between member parties.** Leading member(s) for the development of these indicators. Status on the core list: those noted “Common” have been previously selected in at least one of the OSPAR zones, others are named “Candidate”, eventually with the added status “prioritized”.

Session 2 - The present and future challenges in the Channel: governance researches

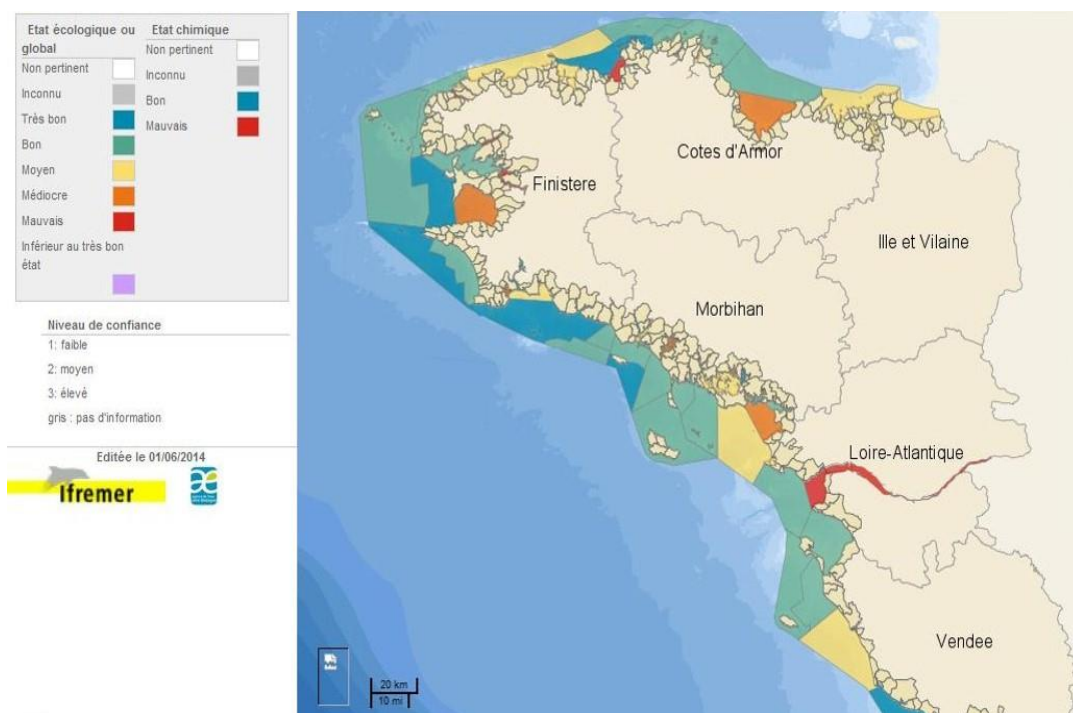
**7. Impact of global changes on living aquatic resources: some reflections.**

Prouzet Patrick<sup>10</sup>

Abstract: The global changes cover the effects of the climate changes and of the other anthropogenic pressure on our environment. These effects are particularly emphasized on the aquatic ecosystems localized between the sea and the continent. These environmental systems that have strong productivity are submitted to multiple pressures that make them vulnerable to change factors. They were deeply modified during the 20th century and numerous habitats indispensable to multiple species were destroyed or highly degraded (Figure 8). It decreases highly the possibility of adaptation de small fishing vessels (coastal, estuarine and continental). A synthetic analysis of the main pressure factors shows that a sectorial approach based on only the regulation of the fishery would not allow to recover a more favourable abundance for most cases to an exploitation that will last only if there is a decrease of the number of fishing industries.

A system approach, integrated the complexity and done at a scale allowing to take into account the pressure factors that influence the different habitats of the aquatic resources to assess their impacts on the productivity and biodiversity of these production areas, need to be done.

The integration of the complexity, of the assessment of the possible risk and of the changes from the precaution principle to the prevention principle require a change from multi-disciplinarity to trans-disciplinarity.



**Figure 8: Assessment of the quality of littoral and coastal waters of the North-West coast of France.**  
@IFREMER and Agence de l'Eau

<sup>10</sup> IFREMER ; patrick.prouzet@ifremer.fr

## 8. Overfishing and the replacement of demersal finfish by shellfish: an example from the English Channel.

Molfese Carlotta<sup>11</sup>, Beare Doug, Hall-Spencer Jason M.

Abstract: The worldwide depletion and collapse of major fish stocks through intensive industrial fishing has raised many concerns about the sustainability of current fishing practices and the effectiveness of existing management measures<sup>12</sup>. Long-term data series such as fishery statistics have been analysed extensively in the last decades to assess changes in fish populations and ecological communities<sup>13</sup>. Since Pauly *et al.*'s<sup>14</sup> pioneering work, the phenomenon of “Fishing Down Marine Food Webs” has been investigated worldwide. The trend for which fisheries have shifted towards much smaller species found lower in the food chain as predatory species have been depleted has been demonstrated in many marine regions around the world through declines in the mean Trophic Level (mTL) of fisheries landings. The present study<sup>15</sup> focuses on the English Channel, a region with a long history of human exploitation where this assessment has never been performed before.

Over the whole time-series of fishery landings which comprises 90 years of data (1920-2010), the mTL has declined significantly from 4.0 unit in 1920 to 3.0 in 2010, a 0.1 unit drop per decade, the fastest rate observed so far in Europe (Figure 9A). Meanwhile total landings have increased substantially since the 1920s thanks to an industrialization of fishing that allowed vessels to exploit deeper grounds further away from the coast with greater efficiency (Figure 9B). The composition of landings from the Channel has also changed dramatically since the beginning of the 20<sup>th</sup> century (Figure 10): shellfish and invertebrates which contributed very little to landings in the first half of the 20<sup>th</sup> century, make up more than half of the total landings since the 1970s while finfish landings declined markedly in the same period. In particular, whitefish species with their highly prized flakes of white flesh have declined considerably in recent landings and large, slow-growing species of sharks and skates were the most affected in the 90-year period of intensive fishing.

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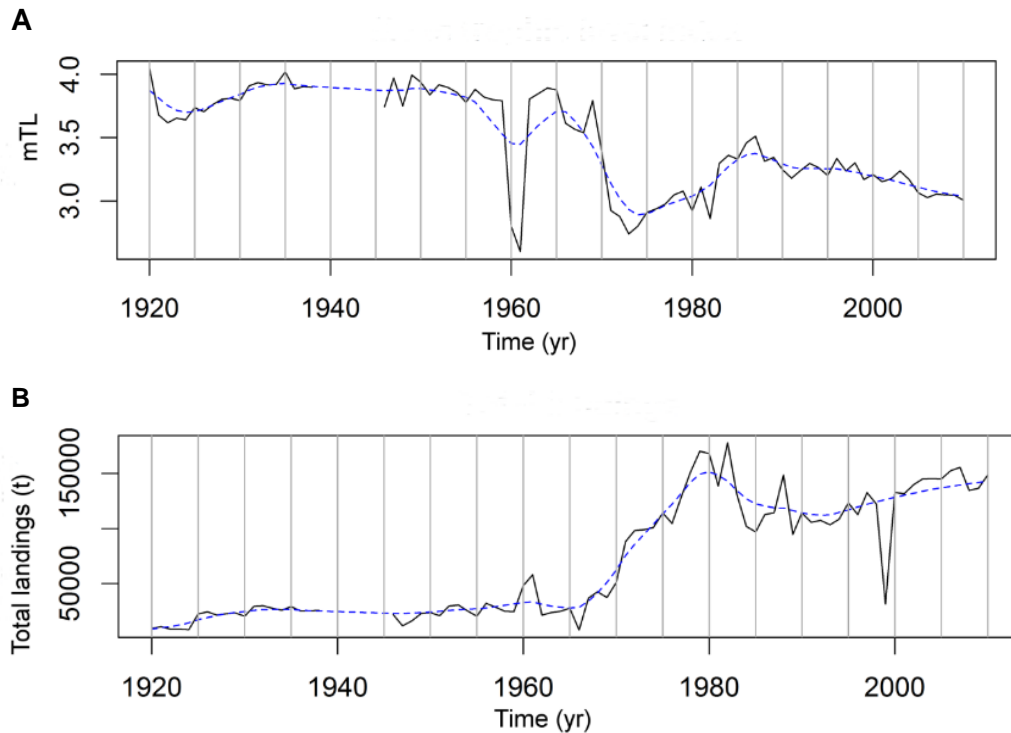
<sup>11</sup> Plymouth University ; carlotta0911@gmail.com

<sup>12</sup> O’Leary BC, Smart JCR, Neale FC, Hawkins JP, Newman S, *et al.* (2011) Fisheries mismanagement. *Mar Pollut Bull* 62(12): 2642–2648.

<sup>13</sup> Pauly D, Chuenpagdee R (2003) Development of fisheries in the Gulf of Thailand Large Marine Ecosystem: analysis of the unplanned experiment. In: Hempel G, Sherman K, editors. *Large Marine Ecosystems of the World: Trend in exploitation, Protection and Research*. Elsevier, the Netherlands. 337–354.

<sup>14</sup> Pauly D, Christensen V, Dalsgaard J, Froese R, Torres F (1998) Fishing Down Marine Food Webs. *Science* 279: 860–86.

<sup>15</sup> Molfese C, Beare D, Hall-Spencer JM (2014) Overfishing and the Replacement of Demersal Finfish by Shellfish: An Example from the English Channel. *PLoS ONE* 9(7): e101506. doi:10.1371/journal.pone.0101506

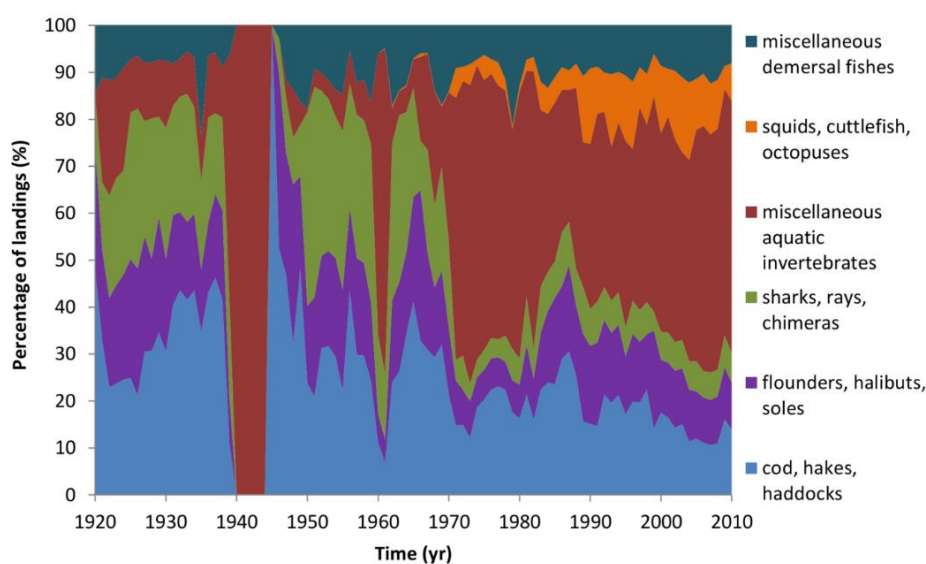


**Figure 9: ICES data for the English Channel for the period 1920-2010.** Analysis excludes pelagic species. (A) Changes in the mTL over time, (B) Annual landings from the English Channel. The blue dashed line is a smoothing function, "supsmu"<sup>16</sup> available as standard with the R software package.

Those figures aren't all about what's in the sea. Market mechanisms create 'perverse incentives' which reinforce the shift to reduced biodiversity. By raising the value of species like scallops or crab it becomes profitable to keep degraded marine habitats as they are. Indeed, if we consider the footprint of beam trawlers and scallop dredges produced by Campbell *et al.*<sup>17</sup>, it seems obvious that it is only scavengers and tiddlers the ones to survive the tremendous pressure exerted by heavy fishing gear on Britain's seabed. Besides, the UK is a net importer of fish: in 2010 most of the cod and haddock supply was freighted in from Iceland and Norway where fishing with trawls and dredges is banned in coastal waters due to the damage it does to fish spawning areas. We simply cannot catch enough of those species in UK waters to meet consumer demand.

<sup>16</sup> Friedman JH (1984) A variable span scatterplot smoother. Laboratory for Computational Statistics, Stanford University Technical Report No. 5.

<sup>17</sup> Campbell MS, Stehfest KM, Votier SC, Hall-Spencer JM (2014) Mapping fisheries for marine spatial planning: Gear-specific vessel monitoring system (VMS), marine conservation and offshore renewable energy. *Mar Policy*: 1–8.



**Figure 10: ICES data on changes in catch composition for the English Channel 1920-2010. Species grouped into ISSCAAP categories.**

Centuries of intensive fishing have upset the ecological balance of the seas around us by removing important components of the food web and by damaging marine habitats essential for the survival of certain species<sup>18</sup>. We documented a shift in the landings from the English Channel towards the cockroaches, rats and mice of the sea to the demise of signature species of the 20<sup>th</sup> century. As with monocultures on land, invertebrate fisheries are easy to manage and initially there's a good return, but the habitat becomes less stable too, more vulnerable to disease, parasites and climate change<sup>19</sup>. That is why we recommend a network of recovery areas closed to fishing to allow the regeneration of marine life and increase the resilience of this highly impacted marine ecosystem.

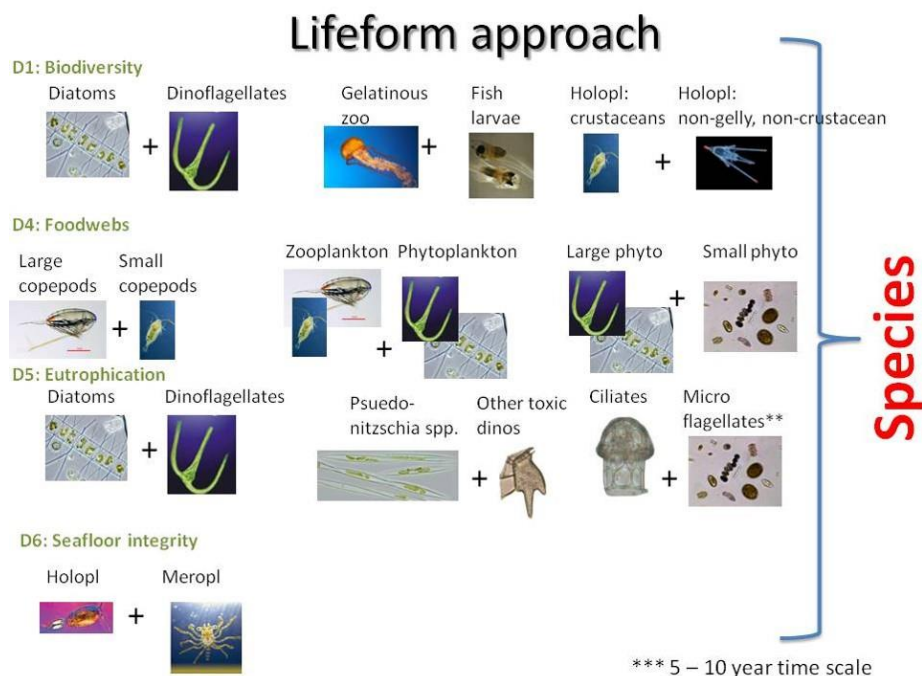
<sup>18</sup> Thurstan RH, Roberts CM (2010) Ecological Meltdown in the Firth of Clyde, Scotland: Two Centuries of Change in a Coastal Marine Ecosystem. PLoS ONE 5(7): e11767.

<sup>19</sup> Howarth LM, Roberts CM, Thurstan RH, Stewart BD (2013) The unintended consequences of simplifying the sea: making the case for complexity. Fish Fish doi: 10.1111/faf.12041.

## 9. Challenges for developing policy indicators in a climate of macroecological change.

McQuatters-Gollop Abigail<sup>20</sup>, Jennifer Skinner

Abstract: Unprecedented basin-scale ecological changes are occurring in our seas. As temperatures warm ocean pH is lowering, sea ice is decreasing, and marine stratification and nutrient regimes are changing. These unparalleled changes present new challenges for managing our seas as we are only just beginning to understand the ecological manifestations of these climate alterations. The Marine Strategy Framework Directive requires all European Member States to achieve Good Environmental Status (GES) in their seas by 2020; this means management toward GES will take place against a background of climate-driven macroecological change. Each Member State must develop indicators and set environmental targets to achieve GES; however, in order to do so an understanding of large-scale ecological change in the marine ecosystem is also necessary. Time-series datasets, such as that from the Continuous Plankton Recorder survey, indicate that North Atlantic and North Sea pelagic dynamics are responding to both climate and human-induced changes, presenting challenges to the development of plankton indicators and targets for achievement of GES in European Seas (Figure 11). The preservation of existing time-series, particularly those which are multi-decadal, is key to the separation of the climate change signal from that occurring due to manageable human pressures. Apportionment of drivers behind ecosystem changes is needed in order to most efficiently manage our resources and construct a realistic vision of GES.



**Figure 11: Method based on life form, an English and OSPAR solution.** This flexible method allows to use different data sets. @SAHFOS

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## 10. Through the portal – improving the flow of information on non-native marine species in Great Britain.

Sewell Jack<sup>21</sup>, Bishop John, Seeley Becky

Abstract: The UK Government funded, GB Non-Native Species Information Portal (GBNNSIP) collects and collates data on non-native species in Great Britain making information available online. Resources include a comprehensive register of non-native species and detailed fact sheets for a sub-set, significant to humans or the environment. Reporting of species records are linked to risk analyses, rapid responses and horizon scanning to support the early recognition of threats (Figure 12). The portal has improved flow of new and existing distributional data to the National Biodiversity Network (NBN) to generate distribution maps for the portal. The project is led by the Biological Records Centre and the Marine Biological Association is responsible for marine non-native species within this scheme. The INTERREG IV funded project Marinexus has included professional research and citizen science work, which has fed directly into the portal. The portal outputs and the work of Marinexus have a range of marine governance applications, including supporting work towards MSFD compliance.

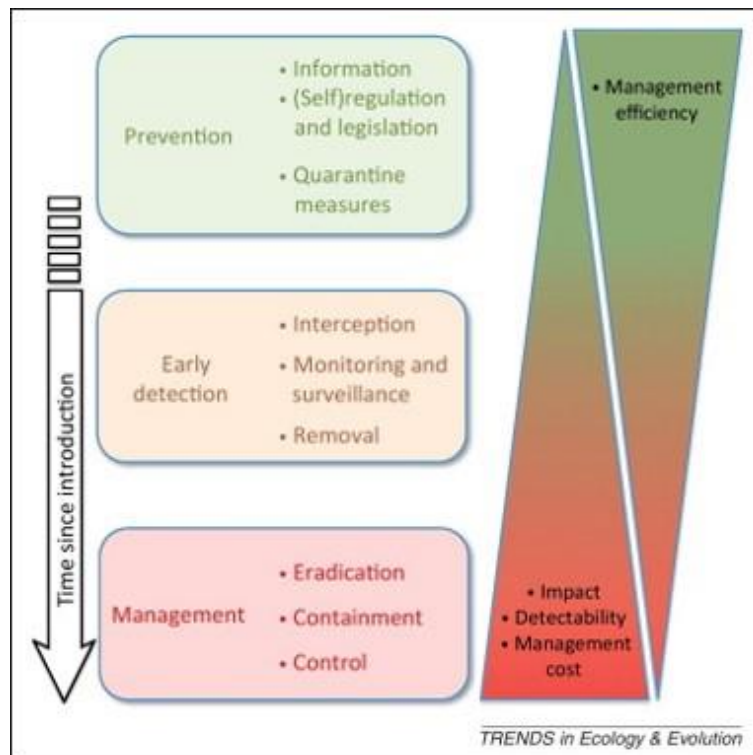


Figure 12: Horizon scanning<sup>22</sup>.

<sup>21</sup> Marine Biological Association ; jase@mba.ac.uk

<sup>22</sup> Simberloff, D., Martin, J.-L., Genovesi, P., Maris, V., Wardle, D.A., Aronson, J., Courcamp, F., Galil, B., Garcia-Berthou, E., Pascal, M., Pysek, P., Sousa, R., Tabacchi, E. & Vila, M. (2013) Impacts of biological invasions: what’s what and the way forward. Trends in Ecology and Evolution, 28, 58–66.

Session 3 - Toward integrated management of the Channel: what are the future research and actions in order to improve the Channel governance?

**11. ICES advice on good ecological status of marine ecosystem: management of international pressures on a common ecosystem.**

Tasker Mark<sup>23</sup>

Abstract: The International Council for the Exploration of the Sea (ICES) is a 110 year old organisation that brings together the work of several thousand scientists to provide advice to managers of European and International seas. ICES is probably best known for its advice on European fish stocks where its work is a key component in their management (Figure 13). More recently it has been heavily engaged in various stages of the defining and implementing of the EU Marine Strategy Framework Directive (MSFD). For some descriptors, ICES work defines both good environmental status (GES) and provides information that evaluates whether or not GES is being met. For other descriptors, ICES has been providing intellectual input in defining both current and potential future indicators (and some thinking as to what GES might look like).

A bigger challenge that MSFD has set European Member States is though common management of Regional Seas. Management should be through existing international bodies such as the Regional Seas Conventions (e.g. OSPAR convention) but there has been very little discussion of what would happen if collective assessment indicates that GES is not being attained in a regional sea. Some existing mechanisms from other policy areas may point a way forward. These mechanisms include the way that fish harvesting is managed in Europe, and how (theoretically at least) carbon emissions are regulated.



Figure 13: The different marine areas explored by the ICES. @ICES

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## 12. Long-term observation of the environment: what are the inputs for improved management of the coastal areas and what are the gaps?

Thiebaut Eric<sup>24</sup>

Abstract: During the last few years, the adoption of different European Directives (Habitat, Fauna and Flora Directives; Water Framework Directive and Marine Strategy Framework Directive) has been reflected by a significant increase in the monitoring of different ecosystem components in parallel with the development of observation programs that result in new avenues for research. These activities, mostly led by academic research actors, enable the accumulation of a considerable amount of data. Beyond the simple need for data, these studies are also important to improve the understanding of the coastal anthropogenic system. Based on different observations undertaken in the English Channel, this presentation will illustrate how the research on long-term dynamics of the coastal ecosystem will provide indispensable knowledge of their management and contribute to answering a number of broad questions:

- What is the meaning of “Good Ecological Status”? How can we define the reference state of a community?
- What is the spatial scale that is necessary to achieve these observations? What is the representativeness of timely and non-frequent observations?
- How can we move from the ecosystem description to a more functional approach?
- Can monitoring contribute to the evolution assessment of ecosystem services and goods from coastal ecosystems? If yes, what approach should be privileged?

In respect of ecosystem services and goods, the focus will be on the contributions that can provide ecological monitoring studying ecosystem changes, changes in ecological functions and changes to ecosystem services.

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### 13. Long-term observation of “top predators” for the marine sub-region of the Channel-North Sea.

Aulert Christophe<sup>25</sup>, Mannaerts Gérald

Abstract: The PANACHE project (Protected Area Network Across the CHannel Ecosystem) aims to work on watch program that are coherent at the Channel scale. A collaboration was created between French and English actors working on marine and coastal birds present in the Channel. Some protocols were then put in place in both sides of the Channel to improve the monitoring of some high values species of birds for some marine sub-regions: tridactyl seagulls, grebes, drivers, terns, cormorants, guillemots, Kentish plovers... This program also aims to place the results obtained into data base to have a tool allowing us to assess the state of conservation of these species along their life cycle. This bilingual database linked to a Web SIG should be delivered by the end of 2014. At the same time, meetings were organised on the French side to determine the monitoring priorities for the present species and the monitoring methods to put in place and to work on a governance way that is optimizing and making the work coherent at a marine sub-region scale by including managers from the marine protected areas, NGO and scientists. The program PANACHE has allowed to test at a full-scale this new organization that seems to satisfy all the French partners. It constitutes the started point for the realization of an observatory focusing on marine and coastal birds for the marine sub-region. This observatory aims:

- To put in place a long-term series of the marine bird populations to obtain a better understanding of the biological and demographical functioning of these populations from the perspective of conservation of natural heritage and the support of the biodiversity.
- To put in place simple, similar (standardised) and reproducible methods on the whole marine sub-region allowing us to assess the conservation state of the bird populations and habitats.
- To have complementary methods of national market (air campaign, monitoring on opportunity platforms...) answering to the sub-region skates.
- To think in term of network of Marine Protected Areas (MPAs) with various scales (sites, regions, sub-regions, national, international).
- To put in place indicators and relevant metrics to inform the dashboard of the MPAs.
- To suggest management measures of MPAs
- To pool the means with the creation of observer network (stakeholders, scientists and NGOs) and to share the data with the creation of a common database usable by all.
- To put in place the monitoring answering to the need of the Bird Directive and the Marine Strategy Framework Directive and to the French commitments concerning the OSPAR convention.

The project is now ready to be generalized to the whole marine sub-region on the French side of the Channel and soon on the English side, we are also trying to work with some Belgian Partners. A similar approach seems necessary for the marine mammals in order to put in place an observatory of “top predators” including birds and mammals. This approach will also include the questions of “human activity interactions / top predators” (knowledge improvement) to answer fully to the different European Directives and to develop an objective of sustainable development of the marine activities.

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## 14. Coastal fishing and governance in France.

Picault David<sup>26</sup>, Lesueur M, Thomas Sophie

Abstract: The project GIFS is funded by the European program INTERREG IV A of the two seas and FEDER (Figure 14). AGROCAMPUS OUEST is part of the Axis 1: “Governance of the coastal zones and marine fishing” in France. The goal is to better understand the different ways of governing coastal fishing activities in order to highlight the best practices and identify the role of fishing in selected areas. The results of the study provide an overview of the way that fishing communities interact with the agencies and key decision-makers at different levels of (local, national and European). AGROCAMPUS OUEST has examined how, and to what extent, fishermen are engaged in governance structures to maintain economic and social viability of the community. Five fisheries were studied in France: scallops in the Bay of Saint-Brieuc, lobsters in the Bay of Granville, “seafood collection” from the Bay of Somme, mussels from the East Cotentin and European Pollock from the sea of Iroise. The conclusions highlighted that the mechanisms, structures and projects used by fishermen and stakeholders to communicate their views and improve governance. The existing management system on the coastal zone is predominantly based on co-management: practitioners work in collaboration with government and scientists. This governance approach allows fishermen to input into local regulations appropriate to meet their needs and also the sustainability of the fishery, in particular with the introduction of management tools such as licensing. . However, this system also has some weaknesses at a local, national and European scale.



Figure 14: The different axes of the GIFS project to improve the governance. @GIFS

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## **15. Building an operational framework for marine ecosystem services assessment: insights from the VALMER project.**

Mongruel Rémi<sup>27</sup>, Pendleton L., Beaumont N., Charles M., Bailly D., Hooper T.

Abstract: Ecosystem assessments are increasingly recommended in order to inform marine policy making and planning. However, there are still no clear guidelines about which of the many possible ecosystem services should be quantified or how to estimate the responses of ecosystem services to factors of change. VALMER (Valuing Marine Ecosystem Services in the Western Channel) is a Franco-British project, funded by the INTERREG IV A programme for the years 2012-2015, which develops new scientific methodologies for identifying which marine ecosystem services to quantify and which policy-driven changes in marine ecosystem services may require more concrete valuation. A triage method is proposed, which combines process-based and content-based approaches for ecosystem assessment, so that the assessment will be both meaningful to the stakeholders, useful for management purposes, and feasible according to the available knowledge and means. The procedural dimension of the VALMER approach for marine ecosystem services assessment makes explicit the role of stakeholders, managers and researchers at each step of the assessment process. The core of the triage process consists of three sequences, each of which should provide specific outputs: the first sequence aims at obtaining a preliminary delimitation of the scope of the assessment in relation to its general aims; the second sequence targets the selection of marine ecosystem services that require further quantification in relation to the considered factors of change; and the third sequence consists in choosing adequate indicators and assessment methods. Illustrations of outcomes from the triage process are presented, based on examples from three VALMER project study sites.

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## 16. Implementing an Integrated Maritime Strategy for the Channel Region.

Thenail Bruno<sup>28</sup>, Aidan Winder

Abstract: The CAMIS (Channel Arc Manche Integrated Strategy) project, funded by the INTERREG IVA France (Channel) - England programme, has i) developed a strategy taking into account the complexity of the issues at the Channel scale; ii) tested tools to improve its governance and iii) defined an action plan. The presentation will start with issues of the spatial scales of governance and action, their relevance and the way they overlap, using concrete examples (i.e. the coastal forums in the UK) and integrating the latest development in France (*Conseils Maritimes de façade*) and in England (Figure 15). It will also show the consistency of the tools proposed by CAMIS and how the project has facilitated the relationship between science and governance, during the project and its achievements. Finally, it will present some project proposals arising from the CAMIS action plan, locating them within the context of the preparation of the INTERREG V A (2014-2020) program and also within the maritime politics of France, England and Europe.

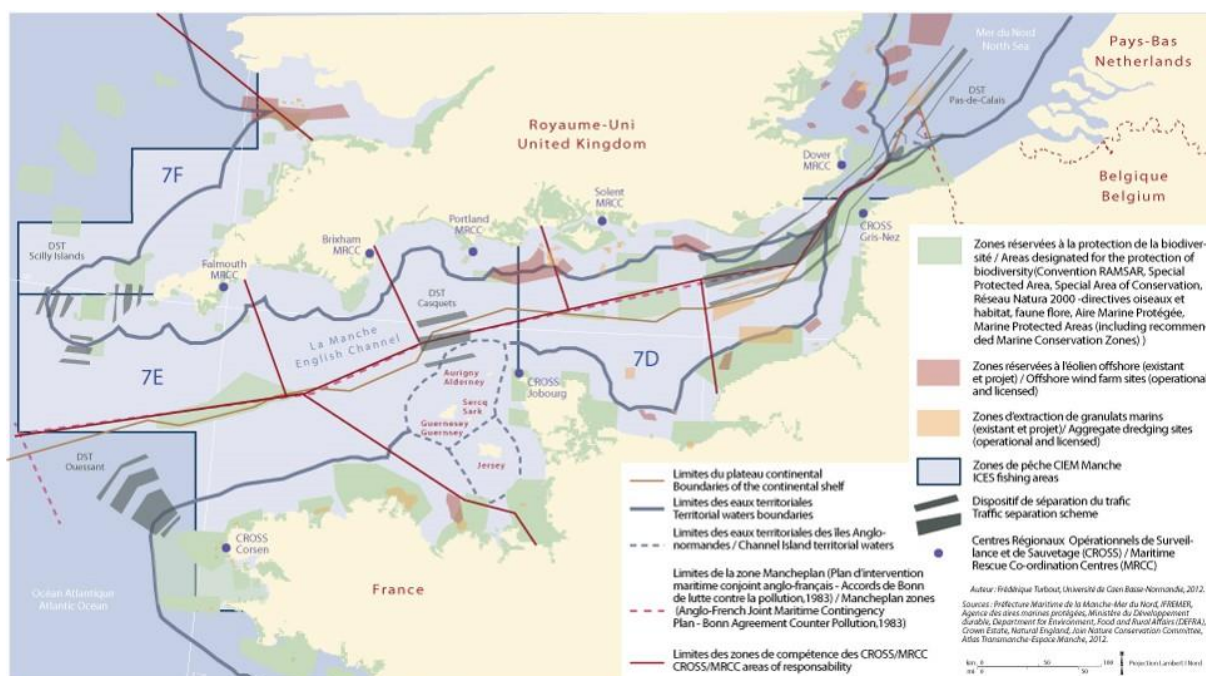


Figure 15: Channel organisation. @CAMIS

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## 17. Marine Governance and Policy – The Channel Seas.

Glenn Helen<sup>29</sup>, Bailly Denis, Le Coz Mari, Donval Nicolas, Thénail Bruno

Abstract: This presentation will draw on work undertaken under the INTERREG IV A France (Channel – England capitalisation project “Promoting Effective Governance of the Channel Seas” (PEGASEAS). Developing the work to-date undertaken within various INTERREG IVa projects and other research projects, the presentation will discuss the complexity of marine policy applying within the Channel Seas and how that policy is manifest within the formal and informal governance processes (Figure 16). The content will build on both the English and French context and cover a diversity of marine issues and sectors. It will also include diagrammatic representations of the policy and governance framework of the Channel. It is hoped that both the policy content and these diagrams will encourage subsequent discussion and stakeholder input.

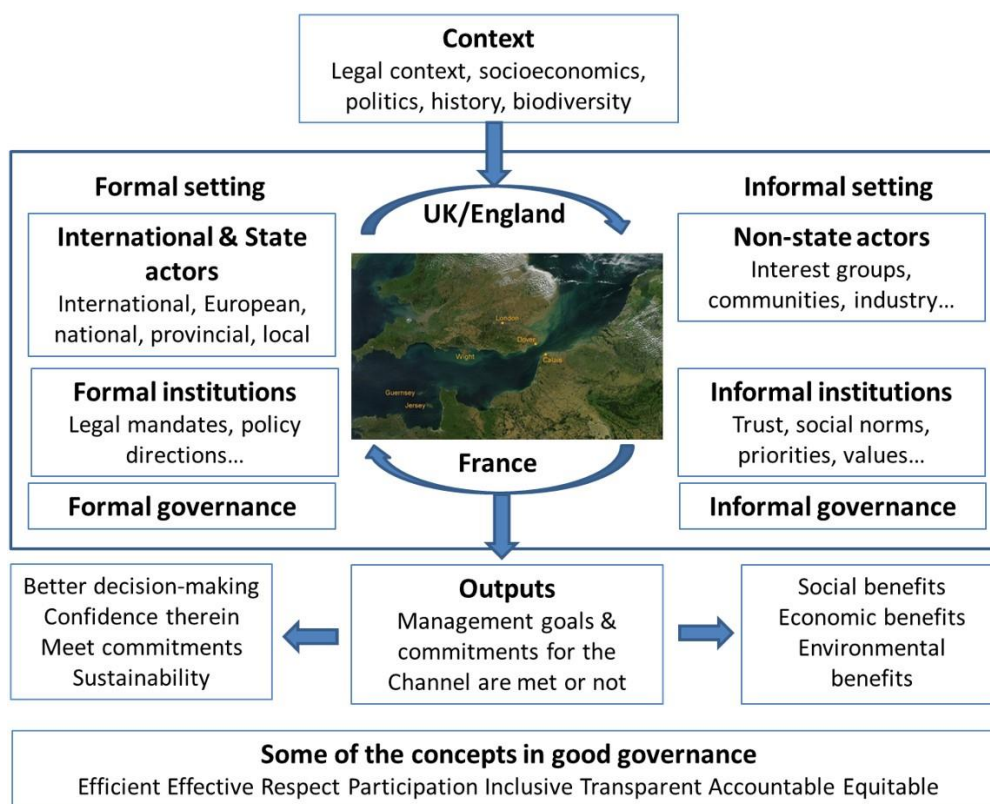


Figure 16: The different governance mechanisms. @Glenn H.

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2. Auzerais A *et al.* LOMC. **Experimental study of sediment sorting in the vicinity of monopile construction.** p.32
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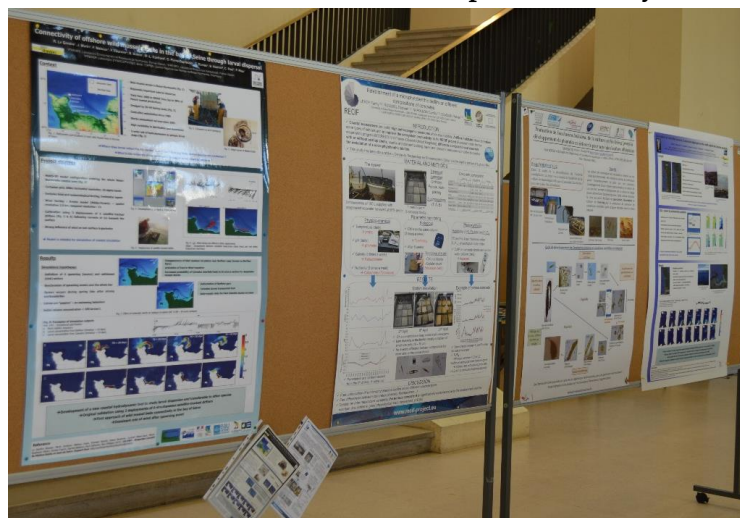


Figure 17: Some of the posters presented during the Forum. @Rakotomalala C.



## Abstracts of the posters

### Session 1 – The Channel ecosystem: actual state, tools and results

#### **1. A new use of Principal Response Curve for summarize community dynamics over time and space.**

Auber A.<sup>30</sup>, Ernande B., Travers-Trolet M., Ching Villanueva M.

**Abstract:** Describing community dynamics often constitutes one of the first steps of statistical analyzes devoted to assess the effects of forcing factors on functional properties of ecosystems. Because of their multidimensional nature, community datasets are often summarized using multivariate analyses. Nevertheless, the majority of these analyses provide ordination diagrams or biplots which are too cluttered to allow simple reading and thus, may lead to interpretation errors. To achieve such difficulties and therefore to provide a simple representation of complex datasets, the Principal Response Curve (PRC) appears as a relevant statistical tool. This analysis distils the complexity of time-dependent, community-level responses into a graphic form that can be appreciated more readily than the results of usual techniques. In addition to the community-level, the PRC method also enables a quantitative assessment of effects towards the species level. The PRC was initially developed in ecotoxicology studies for assessing the effect of toxicants on freshwater communities. In this work, we assessed the amplitude of fish community responses over time in 106 sampling sites in the Eastern Channel. We thus proposed to apply the PRC where the tested factor (usually: ‘toxicant’) is replaced by ‘sampling date’ and the ‘sampling date’ of the usual PRC analysis is replaced by ‘sampling site’. This new version of the PRC permitted to realize a map, easy to read, which summarizes both the temporal dynamics of fish communities and the contribution of each species to the community response in each sampling sites of the Eastern Channel since 1988.

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## 2. Experimental study of sediment sorting in the vicinity of monopile construction.

Auzerais A.<sup>31</sup>, Jarno-Druaux A., Ezersky A., Marin F.

Abstract: We live in a time where the use of wind energy is growing, particularly for offshore wind turbines for which many are placed on monopile construction. These constructions can affect the environment in the coastal zone. Under the influence of hydrodynamic fields, sediment transport can be enhanced in the vicinity of these constructions. In addition, segregation of sediment may occur, which could affect the chemical and biological processes in these areas. We conducted tests in current channels by using three sand types differing in colour and size in order to study the sedimentary segregation induced by monopiles foundations. Initially, the bottom sediments were flat and well mixed. We then followed the establishment of sediment sorting by performing high definition photographs in the vicinity of a vertical cylinder undergoing current action. Bathymetry measurements were performed to characterize sedimentary structures generated in the vicinity of the cylinder, and velocity measurements by ADCP were also realised. It appeared that the sediments were distributed in the same way on the various sedimentary structures created on downstream of the cylinder. We also observed that the vortex system is very complex because it involves the interaction of vortices with horizontal axes (generated at the base of the cylinder and near the top of the sedimentary structures) with vortices with vertical axes coming from the “Bénard-Karman Street”. We are currently working on the interpretation of the sedimentary sorting and will consider its mathematical modelling soon.

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<sup>31</sup> LOMC, UNICAEN ; anthony.auzerais@doct.univ-lehavre.fr

### 3. Combining biological markers to estimate the realized niche species: the case of three flatfish in Seine estuary.

Brind'Amour A.<sup>32</sup>, Dubé B., Laghzali Y., Durieux E., Mahé K., Dauvin J.-C., Alizier S., Le Hir P., Morin J.

Abstract: In the Seine estuary, nursery habitats are critical areas for the juveniles of several commercial species. Habitat fragmentation and habitat loss have been shown to cause a significant decline in fish productivity, involving the replacement of areas of high productivity by less productive areas. Identification of such high-quality habitats requires however appropriate information on species spatial distribution. Most of species habitat models are developed using abundance data, relying on snap-shot information indicating where a species is located on a given sampling date. This type of information implicitly hypothesize that these snap-shot abundance are characteristic of the species "realized niche": One could however argue that developing habitat models using information integrating the life history of a species may be more relevant than using snap-shot data. This study aims to develop a generic method to combine biological markers integrating information on the life history of species in the Seine estuary (stomach contents, isotopic compositions, otolith microchemistry), and compare habitat models developed for three flatfish (sole, solenette, plaice) using the markers index and the conventional abundance data. Results underline spatial correlation between the two indices: the spatial distribution of the markers index being enclosed within the one of the abundance data for the three species. Habitat models developed using the markers emphasize similar realized niche for the sole and plaice, with a high relative contribution of depth and energetic content of their prey. Results from this study should help identifying areas of high ecological importance in the Seine flatfish nursery.

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#### 4. Artificial reef: Setting up monitoring of colonisation at multiple scales.

Claquin P.<sup>33</sup>, Boutouil M., Dashfield S., Dauvin J.-C., Desoche E., Feunteun E., Foveau A., Gallon R., Le Brun J.-L., Leroy F., Lestarquit M., Martinez A.-S., Mussio I., Napoleon C., Orvain F., Queiros A., Roussel D., Rusig A.-M., Widdicombe S.

**Abstract:** The RECIF project proposes to reuse marine mollusc shells (scallops, slipper limpets etc.) to produce concrete that will be submerged in the form of artificial reefs. In this context, we studied at different scales, under different environmental pressures and in different ecosystems, the colonisation processes of concrete with or without shells. We present here the whole experimental approach in place before the immersion of the reef in order to validate our monitoring protocols and explore in detail the mechanisms of colonisation. Concrete and colonisation processes were followed in mesocosms in controlled conditions, in intertidal and subtidal zones. The mesocosm studies permitted the colonisation dynamics of microphytobenthos and evolution of photosynthetic parameters of the biofilm over time to be followed. The interaction between the excretions of EPS (should define EPS here) by biofilm and development of sea urchin larvae were also studied. A second series of mesocosm experiments focused on the processes of colonisation by macroalgae from different phyla and interspecific competition during the fixation process. For the experiments in intertidal areas, conducted in the Bay of Seine (Luc-sur-Mer), the diversity of fauna and flora and dynamics of fixation were followed for one year. Finally, monitoring in subtidal areas was also conducted at three different sites in the Channel: the Bay of Seine, the Normand Breton Gulf and Plymouth Sound. At these sites the diversity of fauna and flora was observed and associated with measures of productivity by coupling benthic chamber measurements and fluorescence modulation (PAM). These measures of primary production should enable us to obtain a reliable indicator, allowing us to estimate the "benefit" of the reef in terms of primary productivity and to subsequently study the transfer of this productivity in the ecosystem.

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## 5. Environmental control of *Pseudo-nitzschia* spp. bloom dynamics and particulate domoic acid concentrations in the Bay of Seine (English Channel, France).

Fauchot J.<sup>34</sup>, Thorel M., Schapira M., Le Gendre R., Riou P., Claquin P.

**Abstract:** *Pseudo-nitzschia* spp. are globally distributed marine planktonic diatoms. Some species of this genus are domoic acid (DA) producers and are therefore responsible for Amnesic Shellfish Poisoning (ASP). In France, several ASP events occurred in the Bay of Seine (English Channel) since 2004. In order to identify environmental factors controlling these toxic blooms, the dynamics of *Pseudo-nitzschia* spp. natural populations and concentrations of particulate DA were followed during one year. *Pseudo-nitzschia* spp. blooms occurred in spring and autumn. Three different species were identified during the spring bloom (*P. australis*, *P. pungens* and *P. fraudulenta*) with high pDA concentrations (4070 ng.L<sup>-1</sup>) resulting in an ASP event in the Bay. Particulate DA concentrations were significantly correlated with *Pseudo-nitzschia* spp. abundance, however *Pseudo-nitzschia* spp. concentrations only explain 30% of pDA variability. The 2012 toxic *Pseudo-nitzschia* bloom was observed in conditions of potential silicate limitation (Si:N<1), when nitrate concentrations were still replete. However, the “nutrient environment” is not sufficient to explain the observed variability in pDA concentrations. This study confirms the coincidence of toxic blooms with the presence of *P. australis* in the Bay of Seine. *Pseudo-nitzschia* species diversity could therefore explain the observed variability in cDA concentrations. These results stress the importance of a species-specific approach in in situ studies of *Pseudo-nitzschia* blooms, along with laboratory studies on the physiology and toxicity of the different *Pseudo-nitzschia* species present in the Bay of Seine.

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## 6. Cultivation of Nori in Normandy. Establishment of red algae culture *Porphyra dioïca*. Support to the NORMAND’ALG project.

Gouhier E, Mussio I<sup>35</sup>, Rusig AM.

Abstract: Following issues of oyster farming in Lower-Normandy that resulted from excess mortality of oyster spat the last few years, the NORMAND'ALG project aims to cultivate algae in oyster farms and thus develop the polyculture in shellfish farming concessions. The goal of this project is to demonstrate the feasibility of cultivating local algal species in shellfish farming concessions. It will also initiate a new aquaculture activity in Normandy for shellfish farmers to produce valuable algal biomass while preserving natural resources. The edible red algae of the genus *Porphyra*, commonly named Nori and used for making makis and sushis grow up on the Lower-Normandy known as *Porphyra dioïca*. The development of the culture of *P. dioïca* requires the control of its complex life cycle alternating between a macroscopic phase and a microscopic filamentous phase named *Conchocelis*. After the stage of sporulation from fertile fronds, the culture of free living *Conchocelis* has been developed. Vegetative propagation of filaments under controlled conditions provides algal biomass as a strain that can be preserved over time. The maturation parameters of the *Conchocelis* strain must be identified in order to induce conchospores which will germinate into plantlets.

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## **7. Problems on a parr? Changing salmon parr size in UK and French rivers and implications for their marine survival.**

Gregory S.<sup>36</sup>, Nevoux M., Ibbotson A., Roussel J.-M., Lauridsen R., Aebischer N., Beaumont W., Riley B.

Abstract: Atlantic salmon stocks have been declining for decades. Studies suggest these declines are driven by factors affecting salmon in their freshwater stage, when they are parr or smolts. We analyse long-term changes in individual salmon parr sizes and examine the evidence for their possible drivers. We built a model to explain variations in observed parr lengths collected over 25 years on three rivers separated by the English Channel: the Frome (Dorset, UK), Oir (Normandy, France) and Scorff (Brittany, France). Our model accounted for spatio-temporal variation due to sampling protocols and differences in their age and sexual maturity. We extended our model to examine the evidence for three potential drivers of changing parr length – river temperature and discharge and parr density. Our analysis revealed a decline in parr length on the rivers that was weakly related to changes in water temperature, discharge and parr density. We highlight actions managers might take to mitigate decreasing parr lengths.

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## 8. Laboratory simulation of the hydrodynamic fields in the vicinity of wind farm masts.

Gunnoo H., Abcha N., Ezersky A.<sup>37</sup>, Mouazé D., Garcia I., Perret G.

Abstract: The aim of the project OFELIA (Offshore Foundations Environmental Impact Assessments) is to establish a cross-channel collaboration between France and the UK, in order to improve our understanding of the environmental impacts of offshore wind farm foundations. The partners in OFELIA are working closely together to address the following questions: (i) Identification of conditions and problems at existing sites, and risk scenarios for future developments. (ii) Physical and numerical modelling of local hydro-sedimentary processes at the scale of the monopile. (iii) Determination of relevant parameters to be introduced into regional models. (iv) Assessment of model improvements at regional scales associated with the local parameterizations. In this reports, we present a laboratory simulation of the hydrodynamic fields in the vicinity of wind farm masts located in the coastal zone. Hydrodynamic fields arise as a result of the interaction of surface waves and currents with the masts. The experiment is conducted in a hydrodynamic channel. Stationary flow velocity  $U$  is 0.16 m/s, the depth of the flow is 0.25 m, the Reynolds number  $Re = Ud/\nu$  ( $\nu$  is kinematic viscosity of water,  $d$  is the diameter of the cylinder)  $Re = 6400$ . Harmonic surface waves of small amplitude propagating upstream were excited by computer controlled wave maker. In the absence of surface waves, a turbulent vortex Karman street with averaged frequency  $f$  corresponding to non-dimensional parameter, Strouhal number  $Sh = fd / U = 0.2$  occurs. The main attention is paid to the effects of resonance between harmonic surface wave and turbulent Karman Vortex Street, arising near the mast. It is revealed experimentally that harmonic surface waves with frequencies closed to  $2f$  can synchronize vortex shedding. On the parameter plane (amplitude of the surface wave, wave frequency), three regions with qualitatively different dynamics of vortices in Karman street are found: absence of synchronization, partial synchronization and full synchronization of vortex shedding by surface wave. The physical mechanisms of synchronization, its impact to the Reynolds stress and the possibility of such a resonance in the vicinity of masts located in the coastal zone are discussed.

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## 9. Connectivity of offshore wild mussel stocks in the Bay of Seine through larval dispersal.

Le Gendre R., Morin J.<sup>38</sup>, Maheux F., Fournier F., Simon B., Cochard M.-L., Pierre-Duplessix O., Dumas F., Harmel B., Paul C., Riou P.

Abstract: In *Basse-Normandie*, deep-water mussel beds are located off the east coast of the Cotentin and fished by 30-40 trawlers. The most important stock is situated off Barfleur. Intertidal and shallow smaller mussel beds are also located in several places along the coast of Calvados. The life cycle of the common blue mussel, *Mytilus edulis*, has a pelagic larval phase during which the larvae are transported by currents. "Where does larval cohort freshly settled come from? What is the influence of meteorological forcing on dispersal patterns?" are issues of interest for professionals involved in mussel fisheries. Hydrodynamic model could therefore be an ideal tool to investigate the connectivity of population through larval dispersal between source input sectors and sink settlement locations. Besides the scientific interest of the project, conducted jointly by IFREMER and the Regional Fisheries Committee of *Basse-Normandie*, the main expected outcome was to contribute to improving the management of this economically important local fishery resource. In order to represent accurately the coastal circulation in the bay, the first objective of the project was the development of a hydrodynamic model and its validation using in-situ satellite-tracked drifters of this area. Spawning events have then been simulated in 8 sectors under various wind regimes. The results showed the major importance of wind conditions following spawning period in the Bay of Seine on larval transport and wild stocks connectivity.

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## 10. Establishment of a microphytobenthic biofilm on concretes of different compositions.

Leroy F.<sup>39</sup>, Roussel D., Napoleon C., Claquin P.

Abstract: Coastal ecosystems are subjected to strong anthropogenic pressures that can cause habitat alteration. The implantation of artificial habitats aims to recover certain habitat types or to increase ecosystem productivity by creating new habitats. In the context of the RECIF project (European program INTERREG IV A France- (Channel) England), different concrete compositions with or without shell were placed in mesocosms to monitor the development of microphytobenthic biofilm. Three types of concrete (ordinary porous and self-positioning) and three compositions (control with scallop shells composition A and B) were tested for five weeks. In parallel to hydrological condition monitoring (temperature, salinity, pH and nutrients), the evolution of diversity, biomass and physiological quality of biofilm were also measured to determine whether the nature of the concrete influenced colonization. The largest biofilms were observed on porous concrete but the highest variability was measured between triplicates. Species diversity of microalgae was equivalent for the different concretes and physiological quality of the biofilm. Under the experimental conditions of mesocosms, the nature of the nine types of concrete tested has little influence on the establishment of a dense biofilm in the early stages of colonization. The immersion of porous concrete blocks in subtidal environment will allow us to test the in situ formation of biofilm and thus observe the early stages of colonization for the future artificial reef.

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## 11. Cultivation of laminaria algae *Saccharina latissima*: from seed to seedling development in hatcheries. Support to the NORMAND'ALG project.

Lestarquit M., Mussio I., Rusig A.-M.<sup>40</sup>

Abstract: Seaweed farming remains a developing industry but seems to be well-received by shellfish farming professionals. The NORMAND'ALG project aims to assess the relevance of the culture of macroalgae in Normandy, including shellfish farming structures in the framework of the diversification of activity. The success of this project depends on the technical control of many skills and especially the nursery phase which enables the production of seed of native algae, which presents an economic interest. In support of the NORMAND'ALG project, the culture of brown algae *Saccharina latissima* for food was monitored through the experimental nursery of the marine station of Luc sur Mer (Centre for Research and Coastal Studies)/*Université de Caen Basse-Normandie*, presenting controlled conditions for seawater temperature and irradiance of cultivation container. The development of the culture of this species requires both controlled seed production and therefore the development of sporulation and fertilization with the potential to maintain free living algae cultivation, culture system that allow the harvest of fertile plants in the natural environment and other pre-magnification seedlings rope. Such a unit seedling production will support production *Saccharina latissima* throughout the year.

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## 12. Colonisation of intertidal rocks by *Crassostrea Gigas* spat on the west coast of the Cotentin peninsula.

Pien S.<sup>41</sup>, Maheux F., Le Gendre R., Dedieu K., Simon B., Gauquelin T., Basuyaux O., Fleury E.

Abstract: For thirty years, French coasts are experiencing development of massive wild oysters stocks. As a probable consequence of global warming, this colonisation tends to expand northward. In Basse-Normandie, the west coast of the Cotentin peninsula represents an important place for oyster aquaculture (around 20% of the French production). Since 2011, HLIN project, leaded by SMEL, aims at implementing a methodology for monitoring and assessing the level of colonization and wild recruitment of *Crassostrea Gigas* on intertidal rocks. Surveys highlighted a high inter-annual variability in spat fixation, both spatially and numerically. During summer 2013, physiological indexes of cultivated oysters (presumed to be « responsible » of larvae dispersal) have been tightly monitored in two sites (Cancale and Blainville) in order to define precisely spawning dates of these areas. A numerical model, validated by satellite-tracked drifter trajectories, has been used to investigate the dispersal patterns issued from the source sectors that supplied mature larvae for fixation. Between these sites, distant from less than 50 km, spawning events showed a one-month delay. The summer 2013 has then been used as study case. Realistic simulations (e.g. tide, winds, freshwater inputs) have been performed in order to study connectivity between cultivated sectors and wild stocks. Model results and in-situ surveys showed good agreement in spat fixation locations. The effect of northerly winds after spawn tended to confine “larval clouds” coming from Cancale to the bay of Mont-Saint-Michel.

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### 13. La remise en suspension du microphytobenthos sous l'effet de la bioturbation des coques *Cerastoderma edule*.

Rakotomalala C.<sup>42</sup>, Grangeré K., Ubertini M., Forêt M., Orvain F.

**Abstract:** In estuarine ecosystems, microphytobenthos (MPB) represents an important part of filter-feeders diet. Hydrodynamic forces combined with biological destabilizing activities, named as bioturbation, allow to the export of MBP in the water column. *Cerastoderma edule* is the major bioturbator species in Baie des Veys ecosystem (Normandy France). *C. edule* destabilizes the sediment by creating irregularities on the surface generating the formation of bioturbated layer. Modifications of the sediment represent local points where erosion starts at low hydrodynamic forces. This study aims to model the effect of *C. edule* on the erosion of bioturbated sediment and associated MPB. Kinetics of chlorophyll a from flume (Erodimeter) experiments were used to parameterize the model of MPB resuspension. Results highlighted that biomass of *C. edule* is a factor which decisively affects the process of MPB resuspension. Our model significantly reproduces the resuspension of MPB under the influence of *C. edule* bioturbation. Independent in-situ data were used to validate the model. A significant agreement was obtained between simulated and measured MPB. This work figures among the first attempts in modelling the chronic erosion of bioturbated sediment and associated MPB in ecosystems where *C. edule* dominates the bioturbating assemblage.

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#### 14. Unusual river discharge pattern and toxic *Pseudo-nitzschia* blooms in the Bay of Seine (Eastern English Channel).

Schapira M.<sup>43</sup>, Le Gendre R., Thorel M., Fauchot J.

Abstract: Blooms of domoic acid-producing *Pseudo-nitzschia* are not perennial events in the Bay of Seine. However two intense toxic events occurred in 2011 and 2012, suggesting an increasing trend in the frequency of these blooms. A better knowledge of the environmental conditions that initiate toxic *Pseudo-nitzschia* blooms is an absolute prerequisite to understand the recent increase in toxic events frequency. In 2012, *Pseudo-nitzschia* spp. abundances and particular domoic acid concentrations ([pDA]) were monitored weekly over an 8-months period at two contrasted sites, in relation to physical (temperature, salinity and stratification), biological (chlorophyll a) and chemical factors (nutrients). Unusual low river flows were recorded in winter 2012. Highest [pDA] (2.5 to 4  $\mu\text{g l}^{-1}$ ) were recorded during early June, following sudden increase in rivers discharge the preceding weeks and co-occurred with low Si/N and high N/P ratios. This result highlights a close relationship between toxic *Pseudo-nitzschia* outburst, excess in nitrogen and rivers discharge pattern. Historical records of domoic shellfish poisoning in the Bay of Seine corroborate this hypothesis, suggesting that climate variability could affect the occurrence of toxic events in bay.

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## 15. What value does taxonomy have in modern science?

Skinner J.<sup>44</sup>

Abstract: Taxonomy is often perceived as an out of date science, however, it is more relevant now than ever before due to increasing anthropogenic and climate pressures. Taxonomic studies enable suitable, responsive indicators to be selected and monitored over time to assess the impacts of drivers, thereby providing essential information to accurately help inform policy in implementing effective and cost efficient management programmes. The Marine Strategy Framework Directive takes an ecosystem approach in promoting a sustainable and healthy marine environment, and relies on indicators to help set useful, practical and attainable targets in its bid to achieve Good Environmental Status in European Seas by 2020. Developing these indicators, however, is a challenging process, but is an essential factor in setting realistic targets that allow for climate changes, and will trigger management action if a manageable pressure is detected. Despite recent technological advancements, taxonomy provides high resolution, high quality information that instrumentation cannot match. In marine ecosystems, instruments are capable of recording bulk indices, for example, phytoplankton biomass; however, the fine detail of species composition is beyond their capabilities and is an essential component in understanding species specific responses to a variety of different pressures. Consequently, indicators derived from taxonomic data, such as those informing pelagic and benthic ecosystem components, are crucial to the success of directives including the MSFD and continue to play an important role in both science and policy.

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## 16. Effects of irradiance and temperature on the physiology of two *Pseudo-nitzschia* species: *P. australis* and *P. pungens*.

Thorel M.<sup>45</sup>, Fauchot J., Raimbault V., Jobert S., Morelle J., Kientz-Bouchart V., Claquin P.

**Abstract:** The marine diatom *Pseudo-nitzschia australis* which produces domoic acid (DA), a toxin causing Amnesic Shellfish Poisoning in humans, is responsible for toxic blooms in the Bay of Seine (English Channel - France). In order to better understand the influence of abiotic factors on the cell physiology of this species, the effects of irradiance and temperature on growth, photosynthetic parameters and DA production were investigated in culture. A *P. australis* strain isolated from the Bay of Seine was maintained in exponential growth phase in semi-continuous cultures under different temperature and light conditions. *P. australis* was able to grow between 3 and 21°C with an optimal growth temperature estimated at 17°C. The stability of *P. australis* photosynthetic parameters under the whole temperature gradient highlights the high thermal-acclimation capacity of the photosynthetic apparatus of this species. However, the decrease in growth rate at the highest temperatures under high light levels revealed the influence of light-temperature interactions on *P. australis* physiology. The results of our experiments also showed that *P. australis* produce DA in exponential growth phase and that DA production is promoted by high temperature and light levels. These results should allow a better understanding of in situ *P. australis* growth capacities, and DA production. Besides exploring processes, these results will help to parameterize future models of growth and DA production for *P. australis*. A similar experiment was run with a *P. pungens* strain also isolated from the Bay of Seine. The results highlight an important inter-specific variability in the growth response of these two species to temperature and light conditions.

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## 17. Effects of herbicides on the Pacific oyster, *Crassostrea gigas* using the embryo-larval and metamorphosis assays.

Mottier A., Seguin A., Kientz-Bouchart V., Dubreule C., Serpentine A., Lebel J.-M., Costil K.<sup>46</sup>

**Abstract:** The summer mortality syndrome which sporadically threatens oyster farming appears to be due to a combination of several intrinsic and extrinsic factors including physiological stress related to reproduction and xenobiotic stress. In this context, terrestrial inputs including pesticides could be involved in oyster mortality events, not as a single causative agent but as additional stressors. The study was carried out in the frame of the European Project CHRONEXPO. The aim of this project was to evaluate the impact of different contaminants (including pesticides) used in the region surrounding the English Channel on marine annelid and mollusc species. In the early stages of *Crassostrea gigas*, experiments were conducted on glyphosate, its main metabolite (AMPA), two commercial formulations (Roundup Express® and Roundup Allées et Terrasses®) and also adjuvants (POEAs: Polyethoxylated tallowamines) alone. Mecoprop, Mecoprop-p and their main metabolite (2-methyl-4-chloro phenol: 2-MCP) were also tested. The effects of these substances were studied in D-hinged larvae in order to assess their potential embryotoxicity by considering both the rate of abnormal larvae (counting) and the kind of abnormalities (multivariate analyses). The effects were also researched in pediveliger larvae ready to metamorphosis (calculations of metamorphosis rates). For each endpoint (embryo-larval development and metamorphosis rates), results of 4 experiments allowed us to determine the EC50 values. As regards embryotoxicity, the 2 kinds of Roundup and adjuvants (POEAs) appeared at least 20-fold and 100-fold more toxic than glyphosate, respectively. The toxicity of 2-MCP reached 4-7-fold those of active substances (mecoprops). In the metamorphosis assay, a similar result was recorded and, glyphosate, AMPA and mecoprops appeared little toxic (EC50 >100 mgL<sup>-1</sup>). Finally, the comparison between the 2 larval stages generally showed a greater sensitivity of D larvae (embryotoxicity) compared to pediveliger larvae. For most of the molecules, results showed that embryotoxicity assay is more sensitive than the classic standardized acute toxicity *Daphnia magna* test. This work is the first part of a study which has been continued by long time exposures providing guidance on pesticide regulation in the frame of the European Directive “Marine Strategy” (2008/56/CE).

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[Session 2 - The present and future challenges in the Channel: governance researches](#)

**18. Seabed habitat mapping from multibeam acoustic data: an image based classification method.**

Alonso M.-F., [Burnside N.-G.](#)<sup>47</sup>

Abstract: A seabed habitat map of the Beachy Head East recommended Marine Conservation Zone (rMCZ), was developed from multibeam acoustic data and ground truth sampling. A seabed habitat map was developed using a Supervised Image-based Classification approach. 152 ground truth still images and 14 grab samples were used as representative training samples to carry out the segmentation and classification of the acoustic data, the two main phases of this technique. Multibeam backscatter intensity and bathymetry derivatives (hillshade, rugosity and slope), were used to develop the map. The accuracy of mapping was validated with independent (still images). The overall percentage of correctly classified points was higher than 75%, and Kappa accuracy assessment determined moderate agreement of the models. Using citizen collaboration would enhance the accuracy of the seabed habitat maps, by increasing the number of training samples available.

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## 19. Searching for ecosystem health indicators based on trophic network analysis.

Astorg L., Tecchio S., Chaalali A., Piroddi C., Patricio J., Lynam C., Niquil N.<sup>48</sup>

Abstract: The search for a pattern of response of food webs, under multiple stresses that affect them, is essential to understand what is good ecological status of coastal ecosystems, particularly in the context of the implementation of the Marine Strategy Framework Directive (MSFD). The European project DEVOTES (DEvelopment of Innovative Tools for understanding marine biodiversity and Assessing Good Environmental Status) was approved, addressing both fishing pressure and those related to climate change. In this context, the study of indices from the analysis of food webs or "Ecological Network Analysis", so-called ENA indices, was performed. ENA indices were extracted from a temporal-dynamic ecosystem model (Ecosim) of the Ionian Sea (Piroddi et al, 2010) to describe their responses to rapid climate change (shift). ENA indices show a response to the shift in the late 1980s (Conversi et al, 2010), with variable sensitivity between different indices. In addition, a shift in the early 2000s was also identified. The shift from 1987 to 1988 leads to a sharp increase in variability of ENA indices, which implies a change in both the organization of flows in the food web and the variability of its functioning. These results suggest that ENA could be a useful tool for describing the ecological status and governance of marine ecosystems.

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## **20. A monitoring survey for integrated ecosystem assessment regarding shellfish culture.**

Gangnery A.<sup>49</sup>, Picoche C., Le Gendre R., Legendre A., Maheux F., Mary C., Parrad S., Simon B.

Abstract: A monitoring survey was developed to i) understand the functioning of an ecosystem supporting shellfish culture, ii) provide field data allowing the development of an ecosystem model and iii) use this model for ecosystem based management. The study is applied to a portion of the West coast of Cotentin (Normandy, France), an important site for mussel culture. Decreases of mussel growth and quality were observed during last years that could be related to high rearing densities. The area was not well known from its physical, hydrological and biological properties. Therefore a first step was to design a complete monitoring survey over 1 year. With a catchment basin of ca. 1100 km<sup>2</sup>, the two main outlets were sampled on a weekly basis to determine all nutrient fluxes. Physics was studied through the deployment of a battery of materials like current meter, wave gauges and probes recording continuously temperature and salinity. Concerning coastal hydrology, five stations were determined where nutrients and suspended particulate matter were measured with a bimonthly frequency. Available food for mussels was also strongly targeted with measurements of chlorophyll a, phytoplankton specific composition and particulate organic matter. Finally, three stations among the previous were identified to monitor mussel growth and quality. Mussels were placed in cages and monthly sampled. Even if this survey was specifically designed to both our site and the pre-existing knowledge, it can be considered as a minimum requirement when monitoring a shellfish system.

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## 21. Study of the element mobility in port dredging sediment after treatment using hydraulic binders.

Hamdoun H.<sup>50</sup>, Baraud F., Leleyter L., Basset B., Lemoine M.

Abstract: This study is a part of the European program SETARMS (Sustainable and Environmental Treatment And Reuse of Marine Sediment). The objective is to study the influence of the mobility of elements using hydraulic binders produced on a dragged sediment to highlight road building techniques. In order to highlight them, it is necessary to improve the knowledge of their mechanic characteristics and the environmental risk. In order to predict and understand the effect of treatment on the metallic and metalloids elements, different protocols of chemical extraction have been realised on the raw and treated sediments. The mobility of these elements was established through different protocols of chemical extractions that are simple, sequential and kinetic. The main results showed:

- A potential weakening of the sedimentary matrix by the treatment, involving an increase in the mobility of As and Cr
- A redistribution of the elements, particularly in the acido-soluble fraction.
- An increase in long term risk for studied metallic and metalloids elements.

These conclusions have been obtained for one sediment, treated with the formulation of hydraulic binders at 180 days. It is important to pursue the study on other sediments, with different geochemical and mechanic characteristics in order to study them at different stages of hardening to improve the knowledge on the environmental impact.

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## 22. Study of the mean trophic level of marine predators: an indicator of good ecological status under the European Convention OSPAR.

Jambut S., Safi G.<sup>51</sup>, Vouriot P., Mialet B., Lamare S., Feral J.-P., Niquil N.<sup>52</sup>, Le Loc'h F.

**Abstract:** The OSPAR Convention is the current legal instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. The work of the OSPAR Commission also includes support to European Union member states that will allow the implementation of the Marine Strategy Framework Directive (MSFD), which covers some of the same regional seas. This includes the development and testing of indicators of good environmental status, including "Marine Trophic Index" (MTI). MTI is the mean trophic level (TL) of marine predators, beyond a certain threshold. To use this indicator, methodological tests are needed to choose the most suited TL threshold (i.e. 2, 3, 3.25 and 3.5) to scientific surveys. In this context, the MTI was tested in the Bay of Biscay using EVHOE fish survey data from 1987 to 2012 and using FishBase for species TL. A decrease of MTI was observed when using overall dataset with a reduction in variability when increasing TL threshold. However, computing MTI only on benthic-demersal community data showed an increase of this indicator from a TL threshold of 3.25. This increase reflects an increasing trend of high TL benthic-demersal species which was not observed with the calculation on the overall dataset. These results show that for campaigns targeting benthic compartments (e.g. EVHOE), it is important to remove pelagic data in order to improve the sensitivity of the indicator.

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### **23. Bioindicators of marine environments: using seaweeds as a tool for biomonitoring the quality of coastal waters. Response to a problem of massive seaweed beaching.**

Lemesle S.<sup>53</sup>, Mussio I., Rusig A.-M., Claquin P.

**Abstract:** In the context of massive seaweed beaching during summer along the French coast of the English Channel in the region of Calvados, the aim of this study is to use the seaweeds to understand the environmental conditions responsible for this phenomenon. The evaluation of eutrophication of coastal waters is based on the use of  $^{15}\text{N}/^{14}\text{N}$  ratio  $\delta^{15}\text{N}$  signatures in seaweed tissues to identify the sources of nitrogen. Five naturally occurring seaweeds (*Ulva sp.*, *Fucus vesiculosus*, *Fucus serratus*, *Chondrus crispus* and *Porphyra sp.*) were collected at two sites (Grandcamp-Maisy and Courseulles-sur-Mer) at two-monthly intervals in 2012. Isotopic signatures ranged from  $5.79 \pm 1.13\text{‰}$  to  $14.16 \pm 0.38\text{‰}$  at the 17 sampling points distributed between the two sites. Seasonal variations in isotopic signatures were observed with low  $\delta^{15}\text{N}$  values in spring ( $5.79 \pm 1.13\text{‰}$  to  $9.37 \pm 0.39\text{‰}$ ) and high  $\delta^{15}\text{N}$  values in summer, autumn and winter ( $8.18 \pm 0.19\text{‰}$  to  $14.16 \pm 0.38\text{‰}$ ). Differences in  $\delta^{15}\text{N}$  signatures were detected between sampling points and in the different species of seaweeds.

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## 24. “Draw me... a sea-earth system”.

Michel C.<sup>54</sup>, Aulert C., Kervarec F., Trouillet B.

Abstract: The research project “draw me...a sea-earth system” (funded by the *Agence des Aires Marines Protégées* and the ecology ministry as part of the program LITEAU) objective is to analyse the inputs of a prospective system, which is part of a sea-earth governance system to build a shared view. The research has been organized around a prospective exercise involving a range of diversified stakeholders from the French side of the Channel. The project has been focusing on the development of spatial and social representations of stakeholders.

The aim of the exercise was to improve the governance dynamics of the *Conseil maritime de façade*.

We suggest that the first presentation of this participative study, are with the construction and the establishment of scenarios for 2050 on the Channel-North Sea. The presentation will present the explorative scenarios, the first common insights for a desirable view and open questions to define the edges of possible convergence.

The talk will show how the convergent and divergent elements of possible views of stakeholders have been integrated in our scenarios and discussed in our reflections. This study asks two questions: Are the shared elements desirable for a higher number of stakeholders? Are the elements of discussions revealed constitutive divergences of different representations or a need for explanation and further common analyses to get the views closer?

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## 25. Phytoplankton events in the Eastern Channel. Watershed impact on toxic algal bloom and eutrophication.

Riou P.<sup>55</sup>, Menesguen A., Cugier P., Le Gendre R., Schapira M., Claquin P., Fauchot J., Gillen G., Garnier J., Vergne A., Mathieu Y., Pedron S.

**Abstract:** The Eastern Channel is a sector potentially impacted by episodic perturbation (i.e. blooms of toxic algae) affected the sanitary quality of a lot of ecosystem and shellfish fisheries. This phenomenon appeared in the Bay of Seine during winter 2004-2005, when ASP (Amnesic Shellfish Poisoning) toxin (caused by *Pseudo-nitzschia* species, known to be toxic) was recorded for the first time in scallops. During 2011 and 2012 winters, another toxic crisis affected all the scallop fisheries in the Eastern Channel. Despite the economic consequences (i.e. fisheries closure), the frequency of toxic blooms, their intensity, the conditions of appearance of toxicity and the relation with environmental parameters need to be further investigated to be able to understand and react better and faster to possible future toxic events. In this context, the FLAM project aims to develop a double scientific and participative approach and the objectives are:

- Acquisition of:
  - Experimental data about the toxic algae blooms determinism and particularly *Pseudo-nitzschia* species;
  - Monitoring data of coastal watershed nutrient fluxes
- Development of an ecological modelling chain from watershed to marine coastal areas
- Scenario construction to test different management strategies (agricultural practices and waste water treatment changes) and predict the impact of toxic algae bloom and eutrophication levels in the eastern Channel.

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**26. CRESH: a project focused on a single marine resource but with a multidisciplinary partnership and outputs concerning a range of management issues.**

Robin J.-P.<sup>56</sup>, Jackson E., Bloor I., Robbins T., Clark S., Koueta N., Grangeré K., Safi. G., Shaw P., Roel B.A., Coppin F., Vérin Y., Foucher E., Gras M., Legrand V., Attrill M.

Abstract: When holistic approaches of the whole ecosystem are favoured it should be reiterated that the ecology of major components of the English Channel ecosystem are still poorly known. The INTERREG IV A project CRESH (Cephalopod Recruitment from English Channel Spawning Habitats) helped to improve knowledge about the cuttlefish (*Sepia officinalis*), the 3<sup>rd</sup> most fished resource exploited by French and English fishing fleets in this area. This project gathered 8 partners with a balanced proportion of universities, research institutes and fishermen's organisations from both countries. Resource renewal was studied from a wide range of scientific fields (scuba diving for spawning habitats, population genetics and juvenile trophic ecology, mixing resulting from migrations and fishing pressure). Because cuttlefish show opportunistic behaviours, preferences are not always easy to detect. However, the project results contribute to underline the role of coastal habitats, which are not equally taken into consideration to identify a single cuttlefish stock within the Channel as a relevant management unit, and propose a biomass model of the stock that enables for the first time routine assessment of fishing pressure.

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## 27. Modelling trophic flows in the Seine estuary: a comparison between habitats of contrasting stress.

Tecchio S.<sup>57</sup>, Tous Rius A., Lobry J., Dauvin J.-C., Morin J., Niquil N.<sup>58</sup>

**Abstract:** The evaluation of Good Environmental Status for marine and freshwater ecosystems, increasingly subject to anthropogenic impacts, is a pivotal issue in marine management. An important tool for the purpose is the modelling of flows in a food web, considering the whole ecosystem, and subsequently applying Ecological Network Analysis (ENA). Here, we present the case study of the Seine estuary, an extremely impacted ecosystem over the last decades. We split the Seine estuary in 6 spatial compartments (Central Navigation Channel, Northern Channel, Southern Channel, and 3 marine areas in the Seine Bay) and used the Ecopath approach to model the flows in each of the 15 compartments and to perform the calculation of ENA indices. Results show that the two most stressed areas were the Central and Northern Channels: the former, where the building works of the Normandy Bridge were conducted in 1988-1995, and the latter, where the extended harbour of Le Havre is considered a major environmental stressor. The typical top-down control, evident in the other modelled areas, was not present in these two areas, showing instead a change in keystone roles of the ecosystem towards lower trophic levels, and higher omnivory than the other areas. The Southern Channel, comprising most of the Natura2000 protected area, showed instead the highest functioning, higher trophic specialization, and low system stress. The Northern Channel then probably the most sensible habitat in the estuary, a condition that should and will be taken into account in future works of impact evaluation.

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[Session 3 - Toward integrated management of the Channel: what are the future research and actions in order to improve the Channel governance?](#)

**28. The DYMAPHY project: development of a DYnamic observation system for the assessment of MARine water quality, based on PHYtoplankton analysis at high resolution by combining multiple techniques.**

Artigas L. F.<sup>59</sup>, Alvain S., Ben Mustapha Z., Bonato S. , Broutin M. , Caillault-Poisson E., Courcot L., Cornille V., Chicheportiche J., Créach V., Degros N., Gentilhomme V., Guiselin N., Hamad D., Hébert P.A., Houliez E., Lefèbvre A., Lecuyer E., Lizon F., Mériaux X., Owen K., Rijkeboer M., Rutten T., Schmitt F., Thyssen M., Veen A., Wacquet G., Zongo S.

Abstract: The INTERREG IV A "2 Seas" DYMAPHY project (Development of a DYnamic observation system for the assessment of MARine water quality, based on PHYtoplankton analysis- 2010-2014), co-funded by the European Regional Development Fund (ERDF), aimed at contributing to a better assessment of the quality of marine waters in the North Sea - English Channel Euro-Region, through the study of phytoplankton and related environmental parameters, at high resolution. In order to assess long term changes as well as to detect short term alerting changes in phytoplankton composition (i.e. suddenly increasing concentrations of harmful and/or toxic cells) reflecting the environmental status and water quality, there is a need of fast, cost effective, innovative, robust and reproducible monitoring procedures that could be applied at high frequency, as a complementary approach to current monitoring networks. By combining innovative semi-automated techniques as pulse-shape recording flow cytometry coupled to image acquisition, spectral fluorescence and remote sensing, the DYMAPHY project developed, within a cross-border effective work, better-standardized procedures for measuring phytoplankton at high resolution. First of all, innovative semi-automated methods were inter calibrated and inter compared, referring to current techniques applied for assessing phytoplankton diversity and biomass (optical microscopy and pigment analysis). Greater automation in data analysis was performed by improving/developing classification approaches within software tools. At last, these procedures were tested and validated in common international cruises carried out in the eastern Channel, the North Sea and estuaries, as well as in routine research and monitoring actions in the "2 Seas" Region.

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## 29. From drivers through impacts to policy responses: aggregate extraction activity in the Eastern English Channel.

Lafite R.<sup>60</sup>, Desprez M.

Abstract: In the future, marine aggregates will probably play a growing role in France, as it is effective in UK, in supplying the building industry with materials, but also in protecting land against coastal erosion by means of beach nourishment. In the eastern English Channel, the largest deposits in continental French shelf, several licensed areas have been performed but in general with low intensity extraction (< 1h.ha-1.y-1), rare cases with high extraction intensity (between 5 and 7 h.ha-1.y-1). Extractions are modifying the topography (furrows, depressions) and the nature of seabed. Habitats alteration and community changes are observed. For example in the Dieppe commercial site, the dredging and fallow zones show shingles colonized by opportunistic worms and by decapods which are prey for demersal fish such as Seabream and Cod. At the reverse, in the deposition zone, clean fine sands are dominating and new specific preys (worms and bivalves) promote Common Sole and Plaice. The degree of change is depending of the intensity of extraction which seems to be a key indicator for the effect on demersal fish species. In that way, adapted exploitation practices, such as low dredging intensity, zoning and absence of screening, are mitigation measures able to minimize the impacts. For regulating authorities, the conclusions of the GIS SIEGMA programme give an added value to the ICES guidelines edited in 2003. The study was carried out by the Group of Scientific Interest “SIEGMA”, supported by the Haute-Normandie Region, Dredging Companies, national and FEDER funding, and implemented through the 7<sup>th</sup> PCRDT VECTORS project.

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### **30. Integration of ecosystem services into local marine management: a participatory scenario approach.**

Morisseau F.<sup>61</sup>, Dedieu K., Mongruel R., Martin J.-C., Cabral P., Kermagoret C., Levrel H., Thiébaud E., Schoenn J., Le Mao P., Foucher E., Daures F., Bailly D., Philippe M., Beganton J., Carrier S., Charles M., Vaschalde D.

**Abstract:** The ecosystem services (ES) concept is undoubtedly useful for highlighting people dependency on their natural environment and for stimulating multidisciplinary and multi-sectoral discussion and research. However, examples of operational use of this approach for supporting decision-making processes are still scarce in the marine environment. The Norman-Breton Gulf, located in the west part of the Channel, is a proposed French Marine Protected Area (MPA) and one of the pilot sites of the European INTERREG project VALMER\*. The MPA creation process in this area provides a rare opportunity to frame the approach and results of applying ES concept at the very base of the management process and to raise a common culture between the different stakeholders. To achieve that goal, 2 main areas of actions are being developed in parallel: (1) A number of methodologies are being explored to quantify, qualify and communicate the economic, social and environmental values of marine and coastal ecosystem services; (2) Participatory scenarios are being developed with local stakeholders on well-focused and realistic issues defined thanks to the implementation of a “triage” approach involving both experts and stakeholders. This co-development will allow to characterize the current state of ecosystem services in the area and the pressures they face while creating a co-learning process by thinking contrasted futures in term of potential ES variations.

\*Valuing Ecosystem Services in the Western Channel

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### 31. Building with the local stakeholders projects of exploitation of marine sediments: results from an experience in Bay of Seine.

Paporé L.<sup>62</sup>, Delsinne N.

**Abstract:** This poster explains the feedback from two projects on marine sediment exploitations located in Bay of Seine for communication between stakeholders. It shows the evolution at the association level of these stakeholders until the co-construction of the project and expertise sharing.

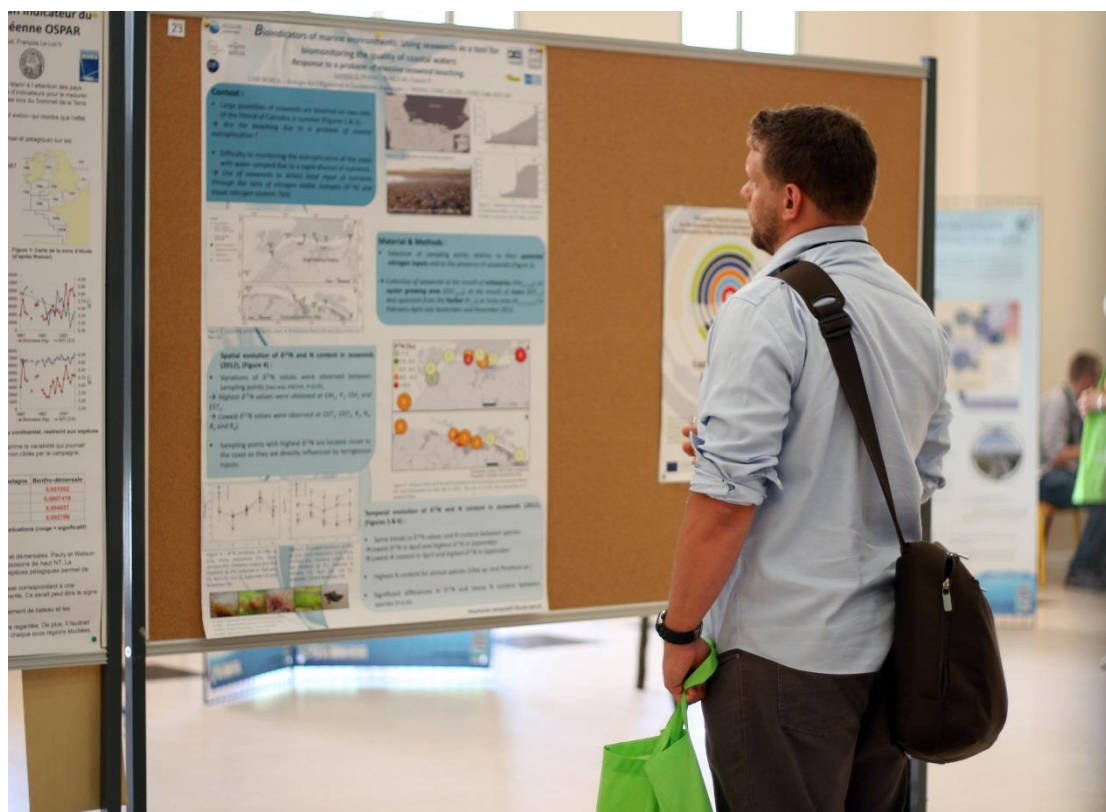


Figure 18: A participant reading a poster presented during the Forum. @Unicaen.

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## Summaries of the workshops

The aim of PEGASEAS project is to promote the efficient governance of the marine ecosystem of the English Channel through the identification and the capitalization of the key lessons obtained from previous INTERREG IV A projects. At the start of the proceedings of the Forum “Science and Governance of the Channel Marine Ecosystem”, it was indicated that a compendium was published and downloadable on the PEGASEAS website.

This compendium presents the analysis realised by the PEGASEAS partners of the INTERREG IV A projects participating to the project (and also some projects outside of PEGASEAS). It aims to identify the main lessons concerning the improvement of the sustainable governance of the marine ecosystem of the English Channel. At the start of the PEGASEAS project, the partners gathered the key elements, the tools and the important results of the INTERREG IV A projects, which were then analysed to produce reports around six selected themes:

- Marine ecosystems dynamics and management
- Pressure and activity on the marine environment
- Governance at multiple scales in the Channel
- Communication and stakeholder involvement
- Management and use of information and data
- Partnership

For each theme, questions were defined by the project partners and reports were written from these questions and the collected data. These reports were also completed by the discussions that happened during the workshops of the first forum organised by PEGASEAS, held in Southampton in April 2014. Each report produced key messages to improve the governance of the marine ecosystem. These messages were in the form of conclusions but also of questions.

During the Forum “Science and Governance of the Channel Marine Ecosystem”, the key messages of these reports were explained at the start of the workshops and then were discussed. Of the six planned workshops, the Partnership workshop did not occur due to a lack of participants, and so will not be discussed in the proceedings. For the other workshops, the participants were from various areas: scientific, politic, decision-maker, management and use (example: fishermen). The aim of the workshops was to collect the opinion of the participants on the conclusions that the PEGASEAS partners had produced, to suggest new point of views and to highlight other ideas and examples to communicate.

## Marine ecosystems dynamics and management

**Sharing of the raw data and the databases** was discussed during the workshop and several ideas were shared. It is important to follow the Aarhus Convention strengthened by the INSPIRE and 2003/4/CE Directives. This Directive INSPIRE aims to promote the spread of environmental information and data online (held by public organisations) in order to communicate the theme of environmental protection to the public. Despite this Directive, there is (1) still a lack of accessibility to raw data and (2) a lack of usable data; due to its complexity, and inaccessibility for non-specialists.

It is a priority that INTERREG projects make **raw data** and metadata available. Accessibility to data owned by private activities and organisations was discussed as an issue. These datasets are often complementary to public data (i.e. sediments extractions, offshore wind farms), but not to national and European programmes. How do we make private organisations’ data more available, in order to feed it into our scientific databases?

There is a **need to share databases between France and England**, to reflect processes in place at the European or international level, for example databases such as OBIS<sup>63</sup> and EUROBIS<sup>64</sup> as well as databases containing long term time-series data (over 10 years). In addition, we should gather historical data from these appendixes and archives.

With regard to the Marine Strategy Framework Directive, it was discussed that there was a **lack of connection between the hierarchy of descriptors and indicators** and also the fact that they should be integrated. For example, descriptor 6 (sea-floor integrity) could integrate the sea-floor on the morphodynamic level but also at the level of the benthic organisms. It also seems important to share and integrate the descriptors and indicators of the different Directives (MSFD, Water Framework Directive and Habitats Directive, for example).

INTERREG IV A projects have produced **potential indicators for most of the MSFD descriptors**. The descriptor for “Marine litter” has not, however, been studied during these projects, although limited data has been obtained by, and is available from, IFREMER and CEFAS. This data should be analysed and integrated in order to determine where the accumulation zones of marine litter are in the Channel. To establish indicators for this descriptor and also for others, we must be aware that answers may depend on the spatial scale, sensitivity and sample size. Therefore, how can we suggest one (or several) indicator(s) for use in the different European Directives and Strategies?

**Long term time-series** (i.e. > 10 years) data were also discussed, particularly their role in policy and decision making. These series are used to observe the evolution of environment quality, systems and their dynamics. It was observed that the answers are often specific and that the species dynamics can vary, following “illogical” variables. One of the issues is that funding such as INTERREG, Horizon 2020 or from the Region, does not exceed several years and rarely a decade, and this threatens the sustainability of these data series. At this time we are trying to put ecosystem management for 20-30 years to come, for example in the case of wind turbines, and we must be able to integrate both climate change and the frequency of events into that management.

With regard to the **tools helping to make decisions**, many tools are already available at the ecosystem level, but it is unclear at what scale they are relevant (i.e. local, regional or global). It is necessary to

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<sup>63</sup> <http://www.iobis.org/fr>

<sup>64</sup> [http://gcmd.gsfc.nasa.gov/KeywordSearch/Metadata.do?Portal=GCMD&MetadataType=0&MetadataView=Full&KeywordPath=&EntryId=\[GCMD\]OBIS.SAHFOS](http://gcmd.gsfc.nasa.gov/KeywordSearch/Metadata.do?Portal=GCMD&MetadataType=0&MetadataView=Full&KeywordPath=&EntryId=[GCMD]OBIS.SAHFOS)

understand that during a period of 3 years (i.e. the length of many European projects) it is not possible to develop a tool, to make it operational and to validate it. There are numerous tools already developed including mechanistic and statistical models; however most of these tools require specialist users to operate them. In order to have a better integration at a European level and with stakeholders and managers, it would be interesting to develop usable “push-button” models that are accessible and usable by a wide range of users.



**Figure 19: Photo taken during the workshop Marine ecosystems dynamics and management.**  
@Pouliquen A.

### Pressure and activity on the marine environment

The first discussion of the workshop was about **the development of common, reproducible methodologies** and adopting best practice protocols to assess both human impacts and the benefits of marine protected areas. It appears that there is no common methodology for different activities in the Channel, although some do exist in some areas; for example aggregate extractions, where European protocols are applied.

It was noted that it is difficult to **update a protocol** when it is already in place for long term monitoring. If the protocol has bias or there are new and better performing technologies, the protocol will need to be modified and updated. However, in some cases, it seems preferable to keep a biased indicator in order to maintain long term historical series data. There is then a need to understand the bias and interpret the indicator accordingly. In order to ensure the robustness of protocols, it is important **to carry out cross-comparisons of protocols** between stakeholders and operators.

The **choice of the exploitation sites** in France and in UK was also discussed during the forum. It was observed that in France the selection methods varied according to the activity. While for aggregate extraction, professionals must be able to justify their choice of site relative to others by conducting studies upstream, it seems that for the Marine Renewable Energy activity impacts are only studied once the site is selected. It would be better to modify the practice for impact study and also to compare French methods with the English ones, where it appears that impact studies are done beforehand.

In addition, it was discussed that **good coordination** existed between France and UK **in the field of marine pollution in the event of major risk**, through the European Maritime Safety Agency (EMSA). EMSA has a fleet of ships available around the European Union to respond to major pollution incidents which carry specialist equipment based on pollutant type.

Regarding dredging, there will always be a significant **impact on the environment**. The issue of piling, i.e. the discharge of dredged materials into the sea, could be better managed. Better management with improved involvement of all stakeholders could also be established.

**The lack of structure to deal with the land-sea interface** was also noted. There are various authorities surrounding this issue, but it requires better co-ordination between the different European Directives (i.e. MSFD, WFD, for example).

The workshop also discussed the theme of fisheries management and the issue of sustainable fishing, **while protecting the ecosystem**. It seems that there is not enough co-operation, and that the managers are focused on France or England, while the fishermen are not the only users or stakeholders that use the Channel and every one follows different rules. It was noted that the degradation of the environment has a negative effect on resources and thus fishing. There are agreements between European countries, but it seems that the rules are not often respected, which may create difficulties for fishermen. For sustainable fisheries, there is a need for improved fishing fleets, with more selective fishing gear, and this would represent an important step forward.

The **formation of a joint management committee** at the cross-Channel level could improve involvement of decision makers and make them understand the potential risks of each activity. This structure seems to already exist for the Celtic Sea region. In such a committee, all the actors associated with different activities should be present to create example of integrated management of activities in the Channel.

### Governance at multiple scales in the Channel

At the start of the workshop, we discussed whether participants had a **mutual understanding of “what is governance and its different scales”**. It was observed that the scales were slightly different according to the country. While France and England were generally comparable at the national and European scales, at more local scales they are different. While in France there are the regions and the localities, in England there are the County Councils that are smaller than the French regions. There are also local councils together with small marinas and ports that are generally privatised. The scales for the Channel Islands such as Jersey are again different. Jersey is not part of the European Union, although they adapt and adopt some of the European legislations as they are part of the United Kingdom. However, Jersey has different systems and scales and they also have international treaties.

It is clear that the scales are important for the different aspects of the governance. The question is: **do we let the scales dictate what the issues are or how to solve them or do we identify the issues and then choose which scale is the most appropriate?** It appeared that the second choice is the most appropriate and that, according to the issues and the involved countries (such as the issue between France and Jersey about the French closing season of the Scallops), the issues could be resolved via different means and scales.

For the issues at larger scales, it would be pertinent to **look at the solutions found in other areas**, such as the Barcelona Convention that fights particularly against marine pollution in the Mediterranean and OSPAR for the Atlantic. One other suggestion to access further solutions is to ask English people what they would do for some French issues and vice-versa.

**The identification of the stakeholders** was also discussed and it was understood that the perception of what they are differs according to the country. There is a need to exchange our experiences to identify who we should contact, how the results should be communicated, and also which ones to communicate. For example in France, the fishermen are meeting to discuss the different problems and to share their solutions.

### Communication and stakeholder involvement

The workshop considered communication methods and stakeholder engagement related to INTERREG projects. The group recognized that firstly all projects needed to **make further effort to communicate and engage with the general public and schools** and to share best. It was agreed that more targeted communication should be done, and that communication should be always be an integral part of projects (especially INTERREG projects).

Proposed subjects for INTERREG V were discussed including **developing a project focused on communication** with schools and general public. It was indicated that, in order to have and keep the public involved and motivated, their role needed to be recognized, they needed to see that they were contributing to the project.

The workshop also considered the **evaluation of the communication effort**. It was recognized that project evaluation is not always done and that there should move toward a more quantitative evaluation. Several methods to evaluate were cited such as a following up with the teacher and/or the parents, a ‘golden book’ inviting comment or a simple ‘pebble evaluation.’

**New possible ways for more participative communication** with people were discussed. It was observed that, where tried, people have commented favourably on participative methods. Some good examples were given such as training the non-scientists; public engagement and explaining the expectations of the decision-makers. There was a recognized need for “new” mechanisms to feed the information back.

The last question considered the **use of new media** to attract and keep more people interested. Participants were keen to use new interacted methods, and several suggestions were made such as creating lotteries and interactive games to promote effective communication. It was noted that for some groups/projects their Facebook pages are often more popular than the official project websites that are running. The use of apps was discussed and noted their growth noted particularly in facilitating interaction with general public and to share the data they are taking. An example given was the jellyfish recording project in Italy that allows the use of an app to upload pictures of jellyfish which help for the record and rapidly they receive news about how safe jellyfish is. Such apps reinforced the need to send quick responses to the general public so that they will feel engaged, continue to help and take on the communication message.

### Management and use of information and data

During the workshop, the discussion was first focused on the difficulties to **collect and share the data** (missing data for some geographic areas or collected data that are non-homogeneous). One of the reasons underlined was the lack of homogeneity between the data collection and data description methods between the organisations and countries.

The question of the **durability of the data and information tools** developed within INTERREG projects was also approached. Indeed, it happens frequently that at the end of projects, the websites that shelter the data are not updated anymore or even disappears.

The **visibility problem** of data, tools and information was also discussed. This is due to a multiplication of the databases and a lack of communication concerning the existing tools.

From these three assessments, different recommendations were discussed that are partly presented below. The **organisation of exchange forums** on existing tools and good practices could help to improve the visibility of existing tools and to exchange about them. In addition, in order to improve the collect of data, the “crowdsourcing” should be supported, i.e. call in for volunteers, general public or professionals such as fishermen.

The **development of a common methodology** for the data collection and management at a France-England, European or international scale for the collect and the management of data would facilitate the sharing and use of data. Some measures have already been taken at the European scale and we have to make sure we use them, to describe the collected data via metadata and to work on common, multidisciplinary and French-English thesaurus.

In order to ensure the durability of the data, tools and information, it is necessary from the project development to plan **what becomes of the data** and also the costs linked to the maintenance of the internet portal. Funding programmes such as INTERREG should take into account this question for the application forms.

To put in place these recommendations, it was suggested that the European programme INTERACT, which aims to share the good practices between the programmes of European territorial cooperation, should create a **specific working group** in order to think about the ways to improve the visibility, the durability and the interoperability of the data and tools. Another idea would be to develop a project of cooperation between France and England that would specifically focus on the collect and management of data, in order to do a state of the art of the developed tools in the maritime domain, to exchange the good practices and to elaborate common methodologies.





## Session Discussion – Round Table

During the three sessions of the Forum « Science and Governance of the Channel Marine Ecosystem”, 17 oral presentations occurred with various research and management subjects, from the biodiversity to the evaluation of marine ecosystem services. Through these presentations, the scientists shared their results and demonstrated the importance of their work, and their perspectives. It was shown that the trans-disciplinary analysis of the marine ecosystem is primordial to have a global view of the ecosystem and its particularities in terms of management. The decision-makers and the stakeholders had the opportunity to take into account the recent scientific progresses and consider what is still left to achieve.

In addition to these presentations, other studies were presented in the form of posters (i.e. 31 posters in total). The special poster session allowed the participants to meet and discuss the presented studies, to exchange their methods or to set out their arguments on the results.

Hélène Marlot (Animation Manager of INTERREG IV A France (Channel) - England, *Région Basse-Normandie*; European affairs and territorial cooperation) presented the perspectives of the cooperation programme INTERREG V France (Channel) - England. INTERREG V is in the continuity of the INTERREG IV but few changes are expected. For example, there would be further eligible zones, the budget will increase and there is a new European framework. Norfolk County Council has been chosen to carry out the function of managing authority in the programme INTERREG V France (Channel) - England 2014-2020. The Channel Islands are still not eligible; however, they can be included as partners if they bring their own funding into a project. This new programme will follow the European Strategies for 2020, focusing on clever, sustainable and inclusive growth. An emphasis will be placed particularly on the results and indicators, and the administrative charges for the project leader should be simplified. There are four thematic axes with five priorities of investment and specific objectives. For the axis 3 “Ecosystem services – green and blue infrastructures”, the results expected for the future projects are (i) the improvement of the actor capacities to promote the ecosystem services and the biodiversity and (ii) an environment that is better protected, a boost to the economy, employment creation, commercial opportunities and improvement of prevention of the ecosystem and its management. Further information on the presentation can be found on the PEGASEAS website.

Stuart Hughes, a councillor from Devon County Council and representative of the Local Government Association, also presented the perspectives of English politicians about the governance of the Channel area. He reminded participants that the role of the local government was to deal with the local population and that it is possible to have a “real” relationship with the population. He also emphasized the need to submit realizable projects within the project time schedule and to provide concrete key elements that will help people to understand them.

One of the subjects that was most addressed during the forum was the improvement of the relationship between scientists, politicians and other actors (stakeholders, decision-makers and practitioners); there is a real need to make more effort to understand each other. The scientists have high capacities to observe the environment and to analyse it, but it seems that they do not always have the best capacity for communication. In addition, stakeholders should also understand that an indicator of scientist performance is an international scientific publication and so scientists do not always have time to prepare different presentations according the audience.

With semantic changes between each domain (i.e. scientific, political, management and user), it seems important to ask for specific funding for communication. It could be used, for example, to employ

people able to communicate by highlighting the important message and the value of the research being done. It could also be possible to use funding to create projects focusing on communication within some specific research subjects such as the project VALMER. This project is still in progress and is funded by INTERREG IV A; it is focusing on the practices used to assess ecosystem services. This project wishes to raise awareness about the services provided by the marine ecosystems to the decision-makers, to analyse the assessments and the scientific results, and to make them understandable so the decision-makers can use them.



Figure 20: Photo taken during the round table. @Pouliquen A.

In addition, to improve the communication between the different actors, it would be useful, as explained in the summary of the workshop “Communication and stakeholder involvement”, to assess the exchange between partners, such as with the general public or the decision-makers. It is important to have the opinion of the participants on the communication at the end of such events (i.e. workshops, meetings and forums) in order to improve them. For example, one of the comments made during the forum was that some presentations were too specialized and, while explained in an understandable way for scientists, were not necessarily understood by other stakeholders or practitioners, especially with the use of specific terms and statistics. After these comments, it was decided to do everything possible to avoid these circumstances for the last PEGASEAS forum, because the aim of these forums is that all the participants can communicate.

The collaboration between the different actors in a project is really important. To have a global integrated vision in a specific area such as the ecosystem services studied in the VALMER project, it is necessary to have a multi-disciplinary collaboration toward a common objective. There is a need for collaborations between scientists and stakeholders and one of the factors that make the VALMER project work is that scientists have accepted the need to analyse datasets that are sometimes incomplete and to draw conclusions from them to meet the need of ecosystem management.

A subject that came out several times during the Forum was the creation of methods and protocols that are reproducible and common between institutions and also between countries; and also for the data collection or for the management of these methods and protocols. By using reproducible methods, it is

possible to produce good, long term time-series that are important tools for making decisions, particularly with the help of models produced using these time-series and analysing the possible changes of populations according to different factors. The use of these models that provide important data to make decisions should be possible by a wide range of users, which is rarely the case. Exchange forums on existing tools could also allow us to share the different practices already developed.

Several future projects were discussed during the forum. It would be interesting, for example, to do multi-stress approaches such as the changes of populations of molluscs according the environment, the temperatures and the level of metal contamination. To study, in addition to the anthropogenic impacts, the interaction between species at the population scale, especially for the commercial species, could provide some important data to manage fishing. However, it is important to remember that we can only manage the human impact on the environment. Even if the marine ecosystem of the Channel is not fully studied, there are numerous data that have been collected over the years and that have not yet been analysed; it would be interesting to gather and study them.

For the management of marine ecosystem, a need for better trans-boundary coordination has been identified for many domains such as fishing. It was suggested that there is a need to create a common management committee for the Channel, which could help to improve its governance. The treaties and conventions made for other seas should be also analysed, for example the Barcelona Convention, and the good practices should be reused to improve the governance of the Channel.

To conclude, the aim of the Forum was to exchange our knowledge and our points of view, and also to talk about future projects for INTERREG V. This Forum seems to have been a success as after two days of presentation and discussion between the participants, some participants discussed the possibility of creating new projects in the diverse domains of the marine ecosystem of the Channel. The ways to comprehend the Channel ecosystem are diverse but the exchanges of practices and shared assessment would support new co-operation and make it more efficient. The sustainable management of the activities which influence the Channel marine ecosystem will also provide benefits to it.

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Figure 21: Photo of the participants. @Unicaen.