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Promoting Effective Governance of the Channel Ecosystem
Promouvoir une gouvernance efficace de l'écosystème de la Manche

06 Assessment of the impact of human activities on marine environment.

ABSTRACT

Ecosystem-based management is an integrated approach to managing human activities to ensure coexistence of healthy ecosystems and those activities. The European Union Marine Strategy Framework Directive (MSFD) identifies that "pressure on natural marine resources and the demand for marine ecological services are often too high" regardless of where their effects occur"[1]. Strict management to preserve natural environments is therefore needed, and the impacts of human activities on the marine environment, in particular, are to be carefully evaluated. While some environmentally sensitive sites are now protected, many had been chosen before the classification of sensitive areas, as locations for implementation of activities with potentially damaging consequences for the natural environment. This report identifies some of the key findings from the Interreg IVA projects analysis (one project not funded by Interreg was also examined as it proved relevant for this report) and identifies examples of further research arising from that analysis.

KEY WORDS

BIODIVERSITY
CLIMATE CHANGE
FISHERIES
MARINE RESOURCE EXPLOITATION
VECTORS OF INVASIVE SPECIES

DESCRIPTION OF KEY FINDINGS

People have always been attracted to coastal areas, spaces which open onto the wider world and which foster economic, social and cultural exchanges. The Channel represents such a space which links Britain and the continent. This narrow strip of land overlooks one of the busiest maritime regions in the world, where many different activities compete and jostle for space.

Commercial vessels, fishermen, military vessels, yachting enthusiasts and tourists are the main actors using the sea, while a range of marine industrial activities are concentrated on land and near coastal waters (for example aquaculture, farming, aggregate extraction, shipbuilding and harbour activities). The region is also home to many activities related to tourism and recreation. More recently has been the development of marine renewable energy sources (MREs) such as wind-farms, on and off shore, which are starting to impact on an already complex area.

1 European Community (2008). *Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)*. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF

Such human uses often generate negative effects on marine ecosystems, and their associated biological diversity. Both sides of the Channel area extend over 5,500 km with a wide variety of landscapes and habitats. The Channel and associated coastal areas are rich ecosystems in terms of biodiversity and commercial fishery resources (CHARM 2 Atlas[2]).

The various projects examined for this report covered a broad range of human activities affecting the Channel ecosystem. These include: businesses operating in sensitive coastal and offshore environments (CAMIS), climate warming, CO_2 partial pressure increase and acidification (Marinexus), marine and coastal tourism (CAMIS), recreational yachting (Marinexus), fisheries, kelp harvest and implementation of Marine Protected Areas (CHARM 3, PANACHE), marine renewable energy (MERiFIC, OFELIA), dredging, sand and aggregate extraction (SETARMS, CHARM 3)

Four main topics have been identified through this assessment of the impact of human activities on the marine environment: (1) managing emergent technologies, (2) managing ecosystems within marine protected areas, (3) managing issues of environmental quality, and (4) cooperation for cross-Channel scale monitoring.

Managing Emergent Technologies

Marine and offshore energies have environmental impacts, which vary depending on according to the location and structures used on the continental shelf and the coastal zones. There is then a need to characterize and quantify these impacts at different temporal and spatial scales.

The lessons learnt on environmental impacts for sustainable energy projects (see bibliographic reviews of research publications in MERiFIC[3] and OFELIA[4] projects), are:

- Marine Renewable Energy (MRE) devices have impacts on the physical processes around the device. The consequences may be felt locally to regionally (see OFELIA project for details) on the sea surface (changes of wave patterns), on the ocean currents (flow speed and direction), on the seabed (scour pits, changes of navigation channels), and also on the coastline (coastal erosion or accretion). In return, these physical impacts have been shown to affect marine life such as seabirds, mammals, fish and benthic communities.
- MRE devices also act as physical barriers (i.e., risk of collision) and generate noise as well as electromagnetic fields.
- MRE devices act as artificial reefs, and hence shelter higher fish densities and biomass than the surrounding pelagic environment.

Ecosystem management in marine protected areas

Several lessons have been learnt with regards to better management of marine protected areas. CAMIS, for example, identified that there is a need for businesses to increase their awareness of sustainability issues and to integrate these into their practices, especially when operating close to conservation areas (such as MPAs or Areas of Outstanding Natural Beauty). In this context, local authorities and policy makers should be expected to bring their support and encourage sustainable development in Small and Medium sized Enterprises' (SMES), by recognising their valuable role in local and regional economies.

In respect of managing fisheries within designated conservation areas, the PANACHE project identified that a common and replicable methodology is needed to identify areas with intense human pressures/impacts and to understand how implementation of spatial management measures may affect the inshore fishing industry. In return assessing the level of risk that fishing activities present to the protected species and habitats in European Marine Sites, and focusing first on high-risk sites, is a good way for decision-makers to identify priorities for actions.

2 CHARM 2 (2009): *Channel Habitat Atlas for marine Resource Management.* Available at: http://archimer.ifremer.fr/doc/2009/rapport-7377.pdf

3 MERiFIC (2012). *Documentary summary of the environmental impact of renewable marine energy*. Section 3. Available at: http://www.merific.eu/files/2/3-2-1_Documentary_summary_EN-MERiFIC-web.pdf

4 OFELIA (2013). *Publications – Article EWEA 2013.* Available at: http://www.interreg-ofelia.eu/

Management issues of environmental quality in the Channel

Some issues that have been identified are related to contamination by hazardous substances such as oil spills and physical damage. For example, the relative abundance of pollution-sensitive species may generate trophic cascade effects and modifications in ecosystem functioning (Marinexus).

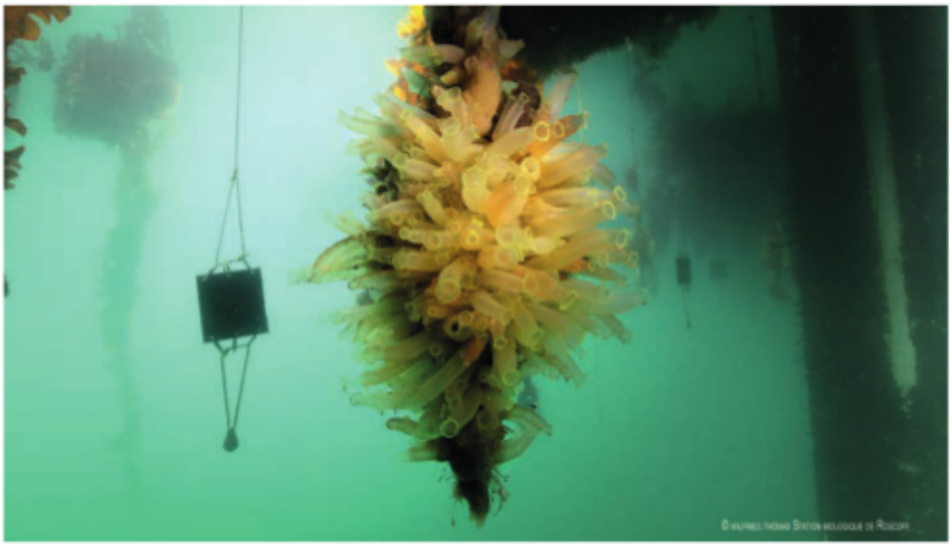
In the context of dredging and substrate extraction, the SETARMS[5] project showed that there is a need to anticipate future environmental regulations, and in particular the equipment to reduce negative effects on abiotic conditions. It is also important to make recommendation for port managers and to have groups and organisations working on the management of harbour sediments at different scales (international, European, France, UK). In a complex regulatory environment, activities are conducted before, during and after risk assessment and actions devoted to reduce negative effects on ecosystems. This requires a serious improvement in dredging techniques and also preventative actions (e.g. providing information and educating users, etc.).

Fishing Boat Heading to Sutton Harbour, Plymouth (© Angela Carpenter / Plymouth University)

In the domain of fisheries, there has always been a conflict between the concept of sustainable fisheries and the short-term economic objectives of fishermen, with fishermen basing their decisions on where and when to fish according to several factors such as size of vessel, running costs and past performance (CHARM 3). The consequences of human activities can be observed for many fish species. For example, there are disturbances on sole (*Solea solea*) population due to nursery habitat degradation and fishing pressure.

Kelp (large brown algae) exploitation should be carefully planned and monitored to prevent spatial discontinuity between populations that would induce deleterious cascade effects along the Channel coasts. Exploitation can alter population connectivity, thus impairing vital gene fluxes between source and sink populations. In addition, seaweed dredging activities can alter seaweeds substrates (i.e., the *Laminaria hyperborea* harvesting apparatus is a dredge equipped with knives which alter the substrate by breaking or turning over rocks and boulders) and should therefore be monitored in experimental sites before authorisation.

5 SETARMS – see http://www.setarms.org/



Monitoring of invasive species in harbours and marinas: on the left, a newly immersed settlement panel; on the right, a panel covered with the invasive ascidian Ciona intestinalis spp after a year of immersion. (© Wilfried Thomas / Station Biologique de Roscoff)

Human activities can also favour the introduction of non-indigenous species. For example, artificial habitats such as ports and marinas provide new substrates (quays, jetties, pontoons and buoys) that may be colonised by native, but also non-native and potentially invasive, species. Maritime traffic and recreational yachting activities are considered as primary dissemination vectors for non-native species via, for example, ballast tanks (see Marinexus project for details[6]) or ship hulls.

Invasive mollusc Crepidula fornicata (© Yann Fontana / Station Biologique de Roscoff)

Climate change effects are characterised by global warming and CO_2 partial pressure increase in the atmosphere. The CHARM 3 project produced several maps showing the probable distribution of key benthic and demersal species in various climate change scenarios (especially temperature increase). Results from the Marinexus project showed different patterns in the control of air–sea CO_2 fluxes in the different provinces of the Western Channel where hydrographical properties differ across the area. As for the effects of climate change on biodiversity, the ability to resist change differs among species. For example, the invasive slipper limpet *Crepidula fornicata* was shown to be resistant to increasing water temperatures and acidification (i.e. atmospheric CO_2 increase).

Cooperating for cross-Channel scale monitoring

It is important to ensure that consistent monitoring exists at a cross-Channel scale; it thus implies the need for common measures to monitor the marine environment, coordinate activities and disseminate examples of best practice.

The PEGASEAS project analysis led us to the following main lessons:

- Despite the development of a transnational overview of fisheries, it is still necessary to integrate data into a common database and to fill gaps in the representativeness of the data relative to the impacts of human activities.

6 Marinexus – see http://www.marinexus.org/

- Further information on the fishing fleets in the UK, France, and the Channel Islands, is needed to improve their management (i.e. vessels number, types of fish caught and fishing gear used).
- A cross-Channel latitudinal approach combining the use of Voluntary Observing Ships (VOS) tracks such as ferries and fixed coastal observatories stations on each side of the Channel provided new insights into the control of air–sea CO_2 fluxes in the Western Channel.

CONCLUSIONS/WORK LEADS

Inputs for future projects:

Scaling aspects
Fisheries: need to acquire both qualitative and quantitative data related to fishing activities in the region scale to gain more insight into the fishing industry and their impacts on marine living resources and ecosystems.

MREs: need for multi-scale research on physical and ecological impacts of MREs, and especially a need for monitoring the environmental impacts of MRE projects at regional scales.

Climate change: the importance of taking into account the hydrological structure of the water column at regional scale was highlighted; an interesting approach was the implication of private structures (cf the ferry companies in Marinexus) for large geographical scale data acquisitions, and partnerships of this type must be encouraged.

Dredging: need for groups and organisations working on the management of harbour sediments at different scales (international, European, France, UK) (cf SETARMS).

Implementation of common methodologies and support of data sharing
Cross-Channel scale studies would greatly benefit from improved data sharing and the use of common/harmonized methods. As identified by the PEGASEAS Cross Channel Forum in Southampton, April 2014, this could be through a budgetary allocation within project funding for consultation and knowledge exchange. That forum also identified the need for improved collaboration and developing relationships between local authorities across France, England and the Channel Islands.

Long-term monitoring
Climate change: need for long-term observation of marine ecosystems to produce better understanding and anticipation of future environmental changes. An interesting approach was the implication of private structures (cf the ferry companies in Marinexus) for large geographical scale data acquisitions, and partnerships of this type must be encouraged.

MREs: need for long-term studies of environmental impacts of MRE devices.

Recommendations for harbours and marina management

Invasive species: coastal navigation and cross-Channel navigation participate in the dissemination of invasive species, by way of ballast tanks and fouling on ships' hulls. This result highlights the importance of the ratification of the 2004 Ballast Water Convention[7]. It also highlights the need for future projects to define specific recommendations for marina managers, and to increase their knowledge of the problem and species concerned.

Dredging and substrate extraction: need for recommendations for port managers

Definition of marine protected areas

Genetic data provide valuable indicators of environmental status and studies of populations connectivity should be conducted prior to the definition of marine protected areas (as in PANACHE).

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7 International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004. For further information see: http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx