



**Towards a joint monitoring
programme for the North Sea
and the Celtic Sea**

ACTIVITY D– ACROSS STATES

Opportunities and Barriers for Joint Monitoring



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Summary

The European Marine Strategy Framework Directive (MSFD) requires Member States (MS) to achieve Good Environmental Status (GES) of their seas by 2020. The MSFD assesses GES using 11 descriptors (e.g. D1-D11) taking account of the Ecosystem Approach. All MS are expected to monitor each descriptor based on a suite of indicators. Therefore, there is a clear need to develop indicators, targets and monitoring programmes towards achieve or maintain GES.

The North East Atlantic MSFD Region is divided into four sub-regions: the Wider Atlantic, the Bay of Biscay and Iberian Coast, the Celtic Seas and the Greater North Sea. Each MS is required to develop a marine strategy for their Exclusive Economic Zone (EEZ). Therefore, it is important that MS work together to implement each stage of the Directive in a coherent and coordinated way, ensuring comparability across Europe. The OSPAR Convention¹ is a key forum to facilitate many aspects of the coordination process.

The present report is a deliverable of the EU funded pilot project “Towards an Integrated Joint Monitoring Programme: North Sea and Celtic Sea”. This project aims to work towards lasting cross-border cooperation for current and future monitoring in support of the MSFD. The project develops proposals for a joint monitoring programme for the North Sea and Celtic Sea, including multidisciplinary sampling (e.g. fisheries and environmental monitoring) and integrated spatial design of sampling.

One of the challenges is to explore to what extent The North Sea and Celtic Sea countries can work together, under similar requirements of the MSFD. Given the current MSFD demands and restricted national monitoring budgets, there is a need to improve the cost effectiveness and to explore how joining forces can help to reduce costs. The Data Collection Framework for fisheries under the Common Fisheries Policy is both a source of inspiration and a vehicle for wider international co-ordination.

The inclusion of both the greater North Sea and the Celtic Sea provides the opportunity to transfer project outcomes to adjacent regions, notably the Bay of Biscay and Iberian Coast. For instance the project has developed a database with metadata on monitoring, options for multidisciplinary use of monitoring platforms and joint sampling designs. Moreover, two sub-regions within the project has brought together a wide range of partners, with a broad range of expertise and created opportunities to share lessons learnt.

This report is a summary of **Activity D (ACROSS STATES)**, which aims to assess the opportunities for joint planning and monitoring across MS and to identify barriers to cross-border collaboration. Activity D conducted two workshops in London, during September and November, 2014. The first workshop was attended by policy makers and monitoring colleagues. The second workshop was targeted to monitoring experts and programme managers. The discussions and recommendations from the first workshop were then used to guide and structure the second workshop, which targeted issues associated with International Barriers (both between Institutes and between countries) to be considered whilst working towards joint monitoring. During both workshops examples of current and future joint monitoring were discussed across the topics of better co-operation, e.g. better use of platforms, data sharing and reporting and assessments. The participants provided suggestions for future monitoring practices.

During the workshops, we conducted a polling exercise covering dedicated questions on current models of monitoring based on the IBTS and CSEMP examples with a high level of coordination, compared to environmental monitoring. See details of the full exercise in section 9 of this report. The main goal of this exercise was to assess the level of cooperation in monitoring from different MS perspectives.

Case studies were presented in the workshops, for example on the Dogger Bank Special Area of Conservation (SAC), that identified aspects of national targets and legal monitoring requirements hampering cross-border collaboration. Issues associated with political and economic drivers were also identified as obstacles to joint monitoring and assessment (see Annex II of this report) .

During discussion at our workshops it was clear that mutual understanding of policy needs and the ability of science (based on an operational possibilities) to inform policy makers would help progress towards meeting legal requirements at acceptable costs. Joint monitoring links stakeholders and therefore could play a key role to improve the current situation.

The report is structured to present the outcomes of each workshop and generic recommendations to support current and future monitoring practices. The main outcomes are listed below:

- i) Common policy drivers, notably the MSFD and CFP, engage Member States in a joint assessment process that is coordinated through OSPAR and ICES at the regional and subregional level. Joint assessments are directly related to monitoring, from coordinated data collection to data management, and need to cope with the various spatial scales that are being used in national monitoring programmes. To enhance the cost effectiveness and statistical power of monitoring there is a need to promote operational cooperation at the subregional level. The North Sea and the Celtic Sea appear suitable units, depending on the requirements of the assessments and operational possibilities;
- ii) Joint monitoring is possible if MS choose to collaborate in survey planning, harmonise protocols for data collection and share data to support (sub)regional assessments. All of these steps will need to be supported and agreed on a top level (e.g. Memorandum of Understanding) and subsequent levels (e.g. monitoring expert to monitoring practitioner), to ensure that the process is cascaded further and is effectively done;
- iii) Joint planning will be supported by sharing actual resources (e.g. staff, vessels, equipment) and subsequently sharing the final outcomes (e.g. data and knowledge) with all parties involved;
- iv) Case studies of current international co-ordination illustrate how political and economic drivers can hamper international collaboration. In addition, case studies explore scenarios for improved results of monitoring and reduced costs. Examples focus on special areas of conservation (The Dogger Bank) and common indicators (marine litter, benthic indices, chlorophyll and elasmobranchs) in this project (Annexes II and III);
- v) The workshops propose the installation of an objective co-ordination group for monitoring that facilitates and complements the existing work being coordinated under other groups (e.g. OSPAR and ICES). This new group would focus on operational aspects of monitoring programmes, including temporal and spatial design, integration across themes and countries, and aiming at maximizing existing resources;
- vi) Such a co-ordination group should build on a living network of monitoring experts (programme managers, scientists and policy advisors) exploring opportunities for joint monitoring. The project JMP NS/CS has produced such a network.

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1. Introduction

The European Marine Strategy Framework Directive (MSFD) requires Member States (MS) to achieve Good Environmental Status (GES) of their seas by 2020 (MSFD, 2008/56/EC). The MSFD assesses GES using 11 descriptors (D1-D11) taking account of the Ecosystem Approach EU MSFD (Elliott et al., 2011; Borja et al., 2010; Van Hoey et al., 2010), the overall process has set dedicated targets over a tight period of time, which is briefly summarised in (Figure 1). For illustration purposes, this section only provides a simplified schematics of the MSFD stages. There are more detailed documents produced by OSPAR, containing a detailed roadmap for MSFD¹ as well as recent published documents such as ‘Finding a common ground’². These documents provide detailed aspects of coordination and cooperation for complying with the EU Marine Strategy Framework Directive within the OSPAR Convention over the period 2010–2020. These reports take account of national obligations across contracting parties under the Directive.

The successful and cost-effective implementation of the MSFD depends on regional cooperation between MS and third countries. The work under OSPAR Commission coordinates monitoring in the North-East Atlantic. This international coordination gives Member States an opportunity to jointly develop monitoring and reporting tools as well as to make them operational in a cost-effective manner³. OSPAR has also provided support to this project ‘Towards joint Monitoring for the North Sea and Celtic Seas’ (JMP NS/CS thereafter). This project aims to build a strong network (‘a living monitoring network’) between all institutions that are responsible for monitoring in the North and Celtic Sea areas, covering the aspects of fisheries and environmental monitoring.

This report is a summary of **Activity D (ACROSS STATES)**, aims to assess the opportunities for joint planning and joint monitoring across MS. This activity seeks to promote ideas and strategies to help implementing integrated monitoring. Activity D aim to ***“To assess the opportunities for joint planning and monitoring across Member States and to provide Member States with strategies which will help them implement integrated monitoring”***

This activity conducted two workshops in London in 2014 which were attended by policymakers, scientists, programme managers and monitoring experts. The workshops were focused on assessing opportunities and barriers associated with the current and future monitoring (workshop agendas and attendees are provided in Annex I). The work planned and discussed during both workshops provided complementary information as these targeted a mixture of colleagues working in marine monitoring (e.g. covering). The first workshop (held in September 2014) was attended by total of 32 representatives, which were mainly policy maker and monitoring experts from The Netherlands, England, Scotland, Ireland, France, Sweden, Denmark, Belgium, Germany, and OSPAR. The main topics discussed were centered on opportunities for joint monitoring. The main themes were: i) development of common target and indicators; ii) international co-ordination; iii) multi-use of monitoring platforms and; iv) data availability, reporting and assessment. The outcomes of the first workshop helped to inform and structure the second workshop. The second meeting was aim to discuss mainly institutional barriers encountered whilst planning and trying to achieve joint monitoring. This workshop (held in November 2014) was attended by 22 colleagues, which were mainly programme managers and monitoring experts, representing The Netherlands, England, Scotland, Ireland, France, Sweden, Denmark, Belgium and OSPAR. The following questions were discussed: i) what are the main issues associated with monitoring in your organization, country?; ii) the main institutional barriers or any other issues which could hamper co-ordination; iii) can you comment on issues associated with data sharing and co-operation (e.g. nationally, internationally)?; iv) suggestions on strategies for improving the current monitoring (e.g. nationally and internationally) and; vi) specific lessons learned from your current monitoring experience and suggest a way forward for International collaboration.

This report is structured to present the main outcomes of each workshop as well as providing generic recommendations to support current and future monitoring practices. Overall, there are clear opportunities for joint

¹ http://www.ospar.org/documents/dbase/publications/p00501/p00501_msfd%20roadmap.pdf (publication number 501/2010).

² http://www.ospar.org/documents/dbase/publications/p00578/p00578_msfd%20report.pdf (publication number 578/2012).

³ http://www.ospar.org/documents/dbase/publications/p00622/p00622_ospar_monitoring_coordination_report.pdf.

monitoring between MS. Although, there are still aspects of monitoring identified during these workshops that could be further improved (e.g. joint planning, sharing data, protocols and better integration). Some of the dedicated discussion provided further suggestions on how the current environmental monitoring could benefit from learning from fisheries monitoring, which is currently internationally co-ordinated and the results are used jointly for stock assessments.

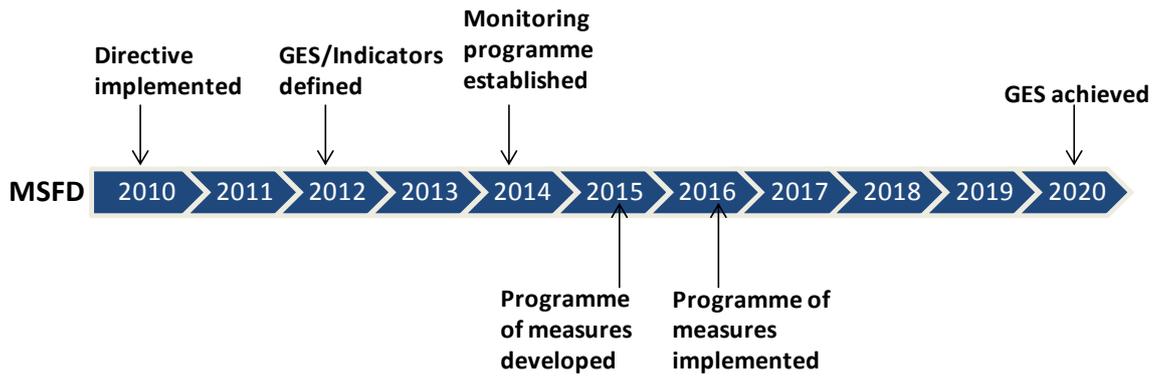


Figure 1. Roadmap of the EU Marine Strategy Framework Directive (MSFD) showing key dates for achieving key stages of the Directive. ©S. Birchenough

2. Workshop 1: Background

Activity D delivered two workshops. The first one took place at Europa House, London (9-10th September, 2014) (agenda and attendees list provided in Section 15. Annex III). The workshop was targeted at: i) monitoring colleagues, ii) members of the Joint Monitoring Programme, iii) colleagues working on the Celtic Sea (TIME project) and iv) policy colleagues from the OSPAR ICG-MSFD. The workshop was attended by total of 32 representatives from The Netherlands, England, Scotland, Ireland, France, Sweden, Denmark, Belgium, Germany, and OSPAR. The main topics discussed centered on opportunities for joint monitoring. The main themes were:

- Development of common target and indicators (facilitated by Lisette Enserink, Rijkswaterstaat, The Netherlands);
- International co-ordination (facilitated by Jo Foden, Cefas UK);
- Multi-use of monitoring platforms (facilitated by Stephen Malcolm, Cefas UK and Ralf van Hal) IMARES, The Netherlands);
- Data availability, reporting and assessment (Bill Turrell, Marine Scotland Science, Scotland and Steven Degraer, RBINS Belgium).

3. Workshop 1: Presentations

Specific activities from the Joint Monitoring Programme project presented their overall progress and the main deliverables per task. These were:

- Creation and population of the data base (Activity A-B)
- Initial discussion with OSPAR Data and Information Management Strategy (ODIMS) on the JMP data base (Serge Scory, RBINS)
- Selection and development of 4 case studies (Chlorophyll a, elasmobranchs, benthic multi-metrics and the possibility to integrate marine litter)
- Activity C workshop delivered in June 2014 (report on the best way to optimise the use of platforms the use of platform)
- Activity D workshop planned and delivered (see Annex I of this report for Agenda and discussion sessions)

During the overview of the overall JMP project, summary presentations of the selected case studies were used to illustrate examples of common indicators, data sharing and monitoring examples. The feedback provided by policy colleagues on the 3 case studies, and on marine litter (which was considered as a potential case study to illustrate Joint Monitoring), are summarised below:

Chlorophyll a, presented by Hans Ruiter (Rijkswaterstaat):

chlorophyll a is monitored by different MS. At present, several methods for extraction and analysis of chlorophyll are being used. A summary overview of different methods and outputs was presented. It was identified that, depending on the analytical methods used, chlorophyll or a combination of pigments is measured, which hampers comparability of the results. Under QUASIMEME there are ring tests to evaluate and compare the results of different methods. Depending on local hydromorphological conditions assessment thresholds differ between areas.

The purpose of eutrophication monitoring was discussed. Since this project has adopted a case study looking at chlorophyll a (as measured by HPLC) or in total phytoplankton biomass (as measured by spectrophotometry or fluorometry) to inform the assessment of MSFD Descriptors 5 (eutrophication) and additional descriptors e.g. D4-food webs). The Chlorophyll a case study will be conducted to evaluate the current methods and provide input under activities C and E within this project.

Elasmobranchs presented by Francisco Marco-Rius on behalf of Anne Sell (V-TI):

elasmobranchs are not abundant species, they have different distribution patterns and several countries have adopted different quantification methods (e.g. presence /absences, ID and quantification to the lowest possible taxon, etc.). Overall, there are very different levels of international collaboration, for example to catalogue rays and sharks and these data sets are stored in the ICES Datas data base. There are issues associated with available, as for some areas these data sets are very detailed whilst for other sites the information is very patchy and the level of resolution is variable for habitats and fishing pressure. There is also a need for ME and the EU Commission to discuss and assess some agreement on the best way to define possible GES for these species, depending on the current available data and state of these species.

Benthic Indicators (in support of D1 and D6 of the MSFD) presented by Gert Van Hoey (ILVO):

benthic indicators are directly related to seafloor monitoring. In the case of multi-metric indicators, there has been an agreement that the main parameters to be measured are total number of species, total number of individuals and biomass. By measuring these dedicated parameters there is opportunity to use existing large scale sampling programmes to assess the level of coverage, detailed habitat and distribution information and assess the required level of sampling effort. This will help to inform a reduction on the level of sampling effort, helping to consider the spatial distribution and the number of stations within shared assessment areas across different countries.

Seafloor litter presented by Thomas Kirk Sorensen (DTU-Aqua) on behalf of Thomas Maes (Cefas):

Marine litter is considered through EU MSFD (Descriptor 10) as well as under the OSPAR Regional Action Plan. Seafloor litter is an indicator specified in the MSFD Commission Decision and is considered under the OSPAR Common Indicator. Litter is a “new” area of science with many knowledge gaps and opportunities. General consensus regarding use of scientific bottom trawl surveys to monitor trends in litter on the seafloor can be a cost-effective effort. The ICES International Bottom Trawl Survey (IBTS) has collected samples in the North Sea since ~ 1970. Seafloor litter has been monitored in these IBTS surveys since 1992, providing a good set of information. There are some data and assessments which will need to be harmonised and improved for MSFD purposes and between OSPAR Contracting Parties.

At present there are many stations sampled in current fisheries & environmental surveys (see dedicated case study on seafloor litter in Annex II), which provide a reasonable detection power. Common approaches to data collection increase detection power and wider detailed assessments can be made on a regional or sub-regional scale. The opportunity to jointly work on the collection and assessment (“together we stand strong”) for marine litter will be advantageous for MS. One of the potential risks are that fisheries surveys may be discontinued and/or altered in the future for reasons outside the scope of MSFD monitoring therefore weakening time series. This case study looks at how opportunities and obstacles related to combining existing surveys to monitor seafloor litter will potentially propose ways of more closely aligning procedures in the future.

International cooperation to monitor and assess the Dogger Bank Special Area of Conservation provided by Charlotte Johnson JNCC, UK, and Vincent van der Meij, Ministry of Economic Affairs, NL:

An example to develop integrated monitoring undertaken by the Netherlands, UK and Germany (*cf.* Annex II, example 1 for more information).

The Dogger Bank (DB) is protected under EU Habitats Directive for its sandbank habitat (~25,000km², which is ~4% of the North Sea) (Annex II, Figure II.1-a). The site itself consists of three separate Special Areas of Conservation

(SACs) identified by UK, the Netherlands and Germany. Each MS is responsible separately for defining conservation objectives and ensuring that site integrity is maintained and/or restored. The International Dogger Bank Steering Group (DBSG) is composed of Ministry representatives and scientific advisors and was set up to agree management objectives for the transnational site (e.g. restore habitat, damaged due to bottom fishing methods due to trawling) (Annex II, Figure II.1-b). The DBSG and International stakeholder group (The Common Fisheries Policy -CFP North Sea Regional Advisory Council) developed and agreed fisheries closures with ICES to protect and restore sandbank habitat. The DBSG is also responsible for monitoring the site, with the aim of assessing the effects of the fisheries management measures (e.g. closure of parts of the site to assess the effects resulted from bottom fishing methods).

See for further details and background information on these examples and case studies Annex II on seafloor litter and the Dogger Bank, and Annex III on chlorophyll a, elasmobranchs and benthic indicators.

4. Workshop 1: Session results

The world café approach (<http://www.theworldcafe.com/method.html>) for multiple topics across different tables was adopted. A summary of the overall discussion points is presented per topic below:

Development of common indicators and targets (facilitated by Lisette Enserink)

- This project needs a real ‘customer’ as a target dedicated group (e.g. policy makers, programme managers) that will benefit from Joint monitoring Programmes to help accomplishment of their tasks under MSFD and other policy drivers. Is there enough ‘added value’ by adopting this style of working, e.g. for: i) cost reduction and/or ii) helping to improve the quality of the assessments.
- *Existing International Coordination*: OSPAR is actively coordinating monitoring between MS, but there are many aspects that need better integration of monitoring. There are monitoring JAMP Guidelines (<http://www.sipe-rtd.info/directive/jamp-guidelines-monitoring-contaminants-biota>), but these are partially employed. There are many other guidelines that are being used, creating the need to adopt one and agree on a common way to promote integration.
- *Need for harmonization*: some aspects of monitoring will require better harmonization, if these are possible options to do so and (long-term monitoring will be difficult as depending on the monitoring programmes there will be long-term data sets, adopted methodologies and assessments that may be difficult to modify entirely. Although, for some of the new descriptors such as noise and litter, there are clear opportunities for jointly planned monitoring.
- *Advantages and disadvantages*: the work needed to comply with MSFD, has forced for MS to work and comply with the required monitoring templates, information (e.g. indicator selection, indicator development, monitoring plans, setting baselines and targets, etc.) over short timescales imposed by EC.
- *Better communication between scientists and policy makers*: there is a real need to better communicate. Scientists will need to propose simple and pragmatic indicators and/or methods. For policy makers there is a need to have a limited set of simple, well developed indicators to start with. These indicators must be science based and take clear account of budget limitations, e.g. ongoing work under OSPAR’s ICG-COBAM. There is a clear need to promote better communication and integration with policy makers and scientists to ensure that needs are understood and there is a clear up-date on current needs.
- *Large areas v/s small areas*: the formulation of indicators and thresholds will need to take account of differences between countries. It is clear that some countries will have to deal with larger sea areas and little resources (money), whilst others will have small sea areas and more allocated resources. The level of monitoring and assessment, and therefore the outcomes, will vary considerably between countries. As such a realistic approach must be considered, the overall assessment should take account of these issues and make some adjustments if necessary.

International co-ordination (facilitated by Jo Foden)

- *Obstacles for a coordinated monitoring programme (Winners and losers):* the need for better joint co-ordination to integrate the level of monitoring conducted is necessary. The result of better integration will create winners (e.g. Institutes that will retain dedicated capability with a certain monopoly of sampling and techniques, helping to continue to strengthen their track record and profile), and losers (e.g. Institutions that may lose expertise, staff and will have to pay and depend on the more specialized organisations to undertake collection, analysis and interpretation of data sets). A way to deal with these issues could be considered based on the Institute's expertise and track record, helping to spread the expertise and ensuring that all Institutes are able to contribute jointly to different aspects of monitoring (e.g. contaminants, benthic fauna, hydrographic survey, marine litter, etc.)
- *Different drivers for integrating monitoring:* there is a need for the adoption of indicators (more often relevant at a sub-regional scale), adoption of power analyses (e.g. show more samples and/or better targeted sampling are needed to increase power). The design of risk-based analysis (e.g. programme that focuses effort on hot-spots of pressure) in an entire (sub) region.
- *Take advantage of the existing cooperation mechanisms:* most cooperation already happens through OSPAR or for fisheries through ICES existing coordination methods (e.g. via existing advisory or working groups such as under OSPAR, ICES, etc.)
- *Options for supporting better International co-ordination:* Top-down, one pot of centrally held money or Bottom-up, build on existing shared monitoring programmes)
- *Ideas for Joint Monitoring Programmes:* A dedicated co-ordination group on monitoring, could set up some dedicated tasks, such as i) identify where most cost can be saved; ii) analyse existing examples and identify best practice and; iii) suggest ways to move forward. Once these tasks have been established then contact dedicated Institutes and policy colleagues and present a plan that could be tested over a small area with several Institutes participating in this initiative.

Multi-use of monitoring platforms (facilitated by Stephen Malcolm /Ralf van Hal)

- *Improve current designs:* This could be possible in some cases, although the real issue will be when there are time-series that have been purposely collected for answering specific questions and long-term assessments could be compromised by adopting a new monitoring survey. A new design could in time help to support some assessments, but equally newly acquired data could create other issues (e.g. comparing data sets over different scales and with less resolution);
- *Maximizing the use of multiple platforms:* The main aspect requiring further consideration is in relation to what are the main "incentives". If this new way of working by 'optimizing' the use of platforms is adopted, what are the real investments that should be considered and trial over a certain period (e.g. over a 4-6 years). This suggestion could be considered by several countries (e.g. programme manager and policy makers) and agree a test trial on how to maximize the use of vessels. This could be done over a fixed period and then re-assessed the effective use of vessels in data collection.
- *Maximizing the use of vessels across MS:* there are clear monitoring programmes in place that could be better integrated (e.g. fisheries and environmental surveys). There is a need to set up priorities so the dedicated questions are resolved over the time available. Also further considerations should be given to what can be realistically added to existing surveys that can be useful. Instead of taken 'opportunistic' sampling that may be unnecessary and may not be conducive to optimize long-term monitoring.
- *Expand on exiting collaborations:* (e.g. search of other additional opportunities. In Sweden some existing linkages already have been further explored with the military agencies. In the UK there are also clear examples where industry (e.g. The British Marine **Aggregate Producers Association** <http://www.bmapa.org/>) has facilitated Regional Environmental Assessments. Dedicated data sets have been collected for different ecological components and the physical environment, helping regulators to inform licensing decisions on the best uses of certain areas, as well as promoting cost-effective monitoring practices.

Data availability, reporting and assessment (facilitated by Bill Turrell /Steven Degraer)

- *Regular Assessments*: data sets are clearly needed to undertake assessments. For example the Quality Status report (2010) covered a large proportion of the North Sea⁴ and highlighted areas where there are clear gaps. There is a need to support the forthcoming QSR (2017) for a regional analysis.
- *Overview assessments*: do need to be supported by appropriate data sets that can help to illustrate their condition and how these areas have changed or improved over time. In some cases MS can choose different indicators and clearly there will be additional set of indicators. There is a need to standardise some of the metrics adopted to ensure the assessments can allow wider assessments under similar types of data sets and information.
- *Data protection issues*: there may be issues with the data collection, as some of the monitoring data may have been collected with a dedicated purpose. Therefore, wider application of the data sets may not be fit for purpose.
- *Data products rather than raw data*: in the majority of the cases MS would like to share data products rather than raw data as data sets were collected with a purpose and the interpretation of the information could be used in an appropriate context.
- *European data center*: there are several data repositories that over time have been popular and continue to be utilized. The European Marine Observation and Data network (EMODnet) has been used for data submission but more work is needed to improve this facility, discussions are ongoing on how to do this.

5. Workshop 1: Recommendations

Workshop 1 provided dedicated recommendations, for helping the level of current monitoring. These messages were grouped into distinctive categories:

i) Communication and opportunities

- Looking for wider opportunities to improve the current OSPAR monitoring and activities during targeted meetings. The work co-ordinated under OSPAR groups seems to be the ideal platform to encourage and promote wider opportunities for monitoring. However, these groups are very focused on their main issues (often under a dedicated theme) and there could be a much more active interaction on the work and needs from the current OPSAR work being developed (e.g. ICG-COBAM). There is a need to clearly promote the dedicated work conducted under OSPAR groups. This could be an opportunity to ensure that the work under OSPAR is clear, simple and cascade across to other groups (e.g. ICES) to ensure complementarity of approaches and scientific support (e.g. testing metrics, providing data and assessments).
- Trying every way to better integrate with groups at an OSPAR and ICES level. Discussion during the workshop identified that some participants feel that the OSPAR work is done is under very insular groups. There is a need to foster better working relationship with colleagues at ICES and OSPAR level. A clear recommendation to encourage collaboration will be that ICES organises dedicated science workshop and invites OSPAR delegates to contribute and agree jointly on the gaps and priorities for research. ICES has also a data management facility and could support OSPAR assessments with dedicated data sets across regional areas.
- Networking with policy makers on a more frequent basis to ensure that messages, priorities and direction are clear and agreed. Under the OSPAR or ICES umbrella, there could be an annual meeting, covering aspects of science to policy with regards to monitoring priorities and gaps. This fora for policy, scientists and monitoring experts could help to discuss and understand priority issues.
- Dedicated collaboration on small scale case studies between MS (e.g. The Netherlands, UK and Belgium) could help to combine methods, platforms and data, over a particular issue (e.g. eutrophication). Over time,

⁴ <http://qsr2010.ospar.org/en/index.html>

more countries could be added to the existing case studies and these type of approaches could help to better integrate monitoring and regional assessment in the North Sea.

- The formation of a monitoring group, which could adopt a tiered approach (including policy makers, programme managers, scientist and monitoring experts) could help to enable dialogue between different levels of monitoring experts/managers and policy makers on a frequent basis (e.g. every 6-9 months). These meetings could help to set priorities, agree on methods and assessments. This initiative could help to gain trust from different experts and support wider assessments.

ii) Improving monitoring practices

- As there are many drivers that are influencing decisions, there is a need to simplify or identify a dedicated policy driver (e.g. MSFD) and decide on the best strategies on how to engage on a practical level. This could be done by deciding on sharing data, planning a joint survey or by sharing a platform that could help to share the monitoring effort and save time and sampling effort.
- Internationalise methods, targets, assessments and tools. These strategies could be discussed on an International coordination committee, ensuring that participation is encouraged and supported by all MS to ensure that joint monitoring is discussed and better co-ordinated.
- Rationalise overlapping surveys, stop information being duplicated (e.g. during monitoring) and promote data sharing. This will help how/where to trim down monitoring programmes.
- Combined efforts during planning monitoring, the suggestions to jointly discuss better integration of monitoring survey should be considered from the start, during the planning of work. The planning stage should also take account of data storage and data sharing. At a National level, this level of co-ordination exists within countries. There is some mileage where these wider discussions should be jointly taken during ICES Experts Groups or under a wider-coordination thorough OSPAR.
- The Defra SEPF (MF 1231) funded project TIME (**Time for Integrated Monitoring Surveys**), mainly working on the Celtic Sea, is a partnership consortium led by Cefas with Ifremer (France), The Marine Institute (Ireland) and The Joint Nature Conservation Committee (JNCC, UK). The aim of this project is to undertake ecosystem level surveys mainly by adding to existing fisheries cruises. This work is concentrating on biodiversity (D1), commercial fish and shellfish (D3), food webs (D4) and seabed integrity (D6) and potentially others.
- The creation of a living network to support monitoring activities and assessments: one of the aims of this project is to create a strong a 'living network' in which members of this project, the policy liaison group and steering group can mutually provide assistance on several aspects of monitoring that will be beneficial for facilitating better International co-ordination between MS (e.g. during data collections, training protocols, data sharing, further direction and continuous communication). This network could be further expanded to ICES, RSC and other institutes with an interest in monitoring.

iii) Data sharing

- It was considered an improved practice, as they are institutes that hold historic and long-term data sets, that would be most useful during assessments (in the case of the MSFD for GES), that may help to illustrate changes, variability or the ability of a system to cope with the dedicated level of activities. Clear, example exists where data is stored and can be readily used for interrogation and analysis (e.g. ICES Datras, EMONET, EMECO).
- Promoting data sharing, seem to be a clear point supported by most participants as by doing this will help to target current monitoring programmes.
- Some suggestions to look at dedicated data bases and agree on a common platform to submit and extract data (e.g. Emodnet is being improved and there are developments for new functions to better map and show the biodiversity data sets (David Connor, DG-ENV *pers. comm.*). This information will then be useful to use in the assessments, such as the QSR, MSFD and other Directives. Another aspect for consideration under data sharing, could be during planning for sea going surveys. Bottom up discussion during a joint cruise

planning could encourage cross border collaboration and helping to maximise the use of a survey vessel by either dividing up the cost of the work or by adopting 'smart-ways' of working and maximising data collection and analysis. Some of these discussions were also covered during the Workshop organised by Activity C (in Brussels in June, 2014), see Activity C report for further details.

6. Workshop 2: Aims and outline

The second workshop was organized at Dover House, London (19th November 214) (see agenda and attendees list in Annex III). The aim of the workshop was to discuss issues associated with institutional barriers encountered during monitoring and if any of these issues could affect joint monitoring practices (e.g. across countries and institutes). The workshop was targeted at colleagues working directly on monitoring (e.g. programme managers and monitoring experts). This workshop was attended by 22 colleagues, representing The Netherlands, England, Scotland, Ireland, France, Sweden, Denmark, Belgium and OSPAR. Pre-meeting preparation was required by all the participants, a series of questions were circulated prior to this meeting, these are listed below:

- What are the main issues associated with monitoring in your organisation or in your country?
- What are the main Institutional barriers or any other issues which could hamper co-ordination (any other problems)?
- Can you comment on issues associated with Data sharing and co-operation (e.g. nationally, internationally)?
- Can you identify ways of improving the current monitoring work/relationships (e.g. nationally and internationally)?
- Could you provide information on specific lessons learned from your current monitoring experience and suggest a way forward for International collaboration?

7. Workshop 2: Session outline

Discussion sessions were held in small sub-groups of ~6-7 participants (x3 groups) with representatives of different countries and expertise. Every group was asked to provide further feedback during plenary, giving opportunity to all participants to input during the wider discussions of the proposed questions. These are outlined below:

Session 1: overall monitoring

- What all of the main issues associated with monitoring in your institute, country?
- Please list the main issues (list and/or mind map approach)
- Please list the main issues; can you identify common issues in your group?
- Rank the top 3 issues

Session 2: Institutional barriers and/or other barriers

- What are the main Institutional barriers or any other issues which could hamper co-ordination (any other problems)?
- Please list the main issues; can you identify common issues in your group?
- Rank the top 3 issues

Session 3: Data sharing

- What all of the main issues associated with data sharing and co-operation?
- Please list the main issues (list of mind map approach)

- Please list the main issues; can you identify common issues in your group?
- Rank the top 3 issues
- Can you offer solutions/ alternatives

Session 4: Ways of working in the future

- Can you identify ways of improving the current monitoring work/relationships (e.g. nationally and internationally)?
- Please list the main issues; can you identify common issues in your group?
- Rank the top 3 issues
- Provide overall message to the group

8. Workshop 2: Session results and Recommendations

This section is a compilation of the key suggestions provided by monitoring colleagues on each of the four working topics. Additional reflections and recommendations on how advance the current state of play is provided in the section below:

Session 1: Overall monitoring issues

There are **clear gaps** based on a combination of policy frameworks, which have different targets (in some cases non-comparable). However, there are current policy frameworks (e.g. MSFD and WFD) that may promote better co-ordination between countries, bringing the opportunities for adding multiple activities and providing a better use of resources. A distinctive message to consider is acknowledge that one driver does not necessarily ‘fits them all’. In the majority of case it will be opportune to assess these dedicated issues over a dedicated scale or area with a specific policy framework in mind.

Overall, there clear evidence that some **MS are still very independent** and there is some duplication of monitoring, generating loads of additional data sets, that in most cases these are not being fully utilised. The overall monitoring information submitted to the Commission (under Article 11)⁵ demonstrates the very independent level of monitoring currently undertaken by MS. OSPAR has taken a very active position in promoting a regional plan to improve adequacy and coherence of MSFD implementation 2014-2018⁶. These discussions are providing a good forum to discuss ways to improve MSFD implementation, and ways to better coordinate activities at the level of the Regional Sea Convention. The overall conclusions, indicated that OSPAR EU Member States agreed to: i) Continue working together to improve adequacy and coherence of the MSFD implementation addressing the recommendations of the Commission in a coordinated way and ii) Revisit the existing OSPAR Contribution Document to the EU-CIS, OSPAR ICG MSFD-working plan and parts of the working plans of relevant OSPAR-Committees dealing with matters related to the implementation of the MSFD, based on the conclusions of this regional meeting and a gap analysis to overcome the shortcomings identified in the initial assessments of 2012.

There is still very much the **sense of autonomy between MS** and their institutes, which would like to remain at the fore front of the technologies and keep their capabilities. It is clear that there is not a direct or clear way to immediately, provide the clear solution for better integration. Some countries have started to discuss (e.g. France,

⁵ <http://rod.eionet.europa.eu/obligations/611>

⁶ http://ospar.org/html_documents/ospar/html/ospar_regional_plan_action_msfd_imp.pdf

Ireland and the UK) on how it is the best way to complement efforts and what can be realistically achieved over short and long term scales. These types of further discussions needs to be discussed at all levels (e.g. ministerial/policy makers) as well as on the more operational aspects (monitoring/programme manager and scientists). The full process should take account of these discussions (e.g. at all levels) to ensure that the new proposal for monitoring are realistic and robust.

There are still **clear divisions during monitoring undertaken in the fisheries sector when compared to the environmental monitoring**, this may be due to the different number of institutes and the funding mechanisms. For example, under the fisheries model, there is a clear economic incentive and a much better and integrated joint monitoring initiative, based on a clearer economic gains, (e.g. considering aspects of money to support better design and fit for purpose monitoring). The environmental monitoring lacks on a clear economic incentive and therefore, it has different aims and outcomes of information are made to decide on condition rather than economic quotas, which is the case for the fishing example of monitoring.

The need to **better integrate for Joint Monitoring Programmes**, may be sustained by countries which will comply with MSFD, as these countries will need to undertake similar level of monitoring with a common goal, which is to achieve GES. In order to better integrate it will be necessary to consider key issues associated with:

- 1) Different methodologies employed;
- 2) Better co-ordination (level of assessment/effort, fisheries discussing plans with environmental colleagues to promote true integration) and;
- 3) Undertake in-depth analysis to maximise the use of data, will help to continue with a fit for purpose monitoring.

DG-Environment is very interested in promoting direct regional co-ordination. DG-Environment could create and support workshops to develop a more regional approach (e.g. North Sea countries) wishing to adopt joint monitoring. This opportunity could be partly funded by DG-Environment (e.g. 50%) and the countries that wish to participate could also contribute with 50% funding. This could be a direct collaborative partnership promoted and supported by DG-Environment and equally also supported by OSPAR and ICES. These meetings could bring a series of members, helping to discuss science needs, advisory requests and other aspects to achieve joint monitoring (e.g. sharing data, better dialogue between countries, helping to plan joint surveys and share data sets for wider assessments). OSPAR could play an instrumental role fostering integration by promoting harmonisation of methodologies and bringing lessons learnt from previous experiences. Working examples of ongoing co-ordination are being observed under the OSPAR Hazardous Substances and Eutrophication Committee⁷

Session 2: Institutional Barriers and/or other barriers

A mandate of Institutes exists with different ecological, environmental and fisheries expertise. Some of these skills are very much in connection to the funding available and the priorities set for each organisation. Some institutes are also under direct competition with Universities, which can sample and analyse data cheaper and faster. There is also a real need to set up protocols and guidance to make sure that even if these analyses are done cheaper the overall results are fit for purpose. At present there are many guidelines and protocols available, that it will be more efficient to agree and follow on single document. This single document could be a 'living' document being up-dated as new methods and analytical procedures are available. Helping to encourage MS to adopt the most cost-effective and be able to adapt to the most optimum method, promoting better dialogue and integration between countries.

⁷ http://www.ospar.org/content/content.asp?menu=00200304000000_000000_000000

There is a need to consider the **4 G's** which are: **Guidance, Goal, Government and Governance** to ensure that needs and outcomes are fit for purpose but also with the view to support the current priorities and enable development of monitoring. Clearly there is the hierarchical level of complexity (e.g. internal institutional level, national level between agencies and trans-national level).

Overall, given the complexity of national and international policy, groups (e.g. Regional Convention), areas designated as Marine Protected Areas and different incentives associated with monitoring. There is a need to build on existing expertise to canalise the current monitoring effort into a dedicated monitoring group (e.g. a joint North Sea monitoring group), which could be based on scientific developments and technology under the ICES umbrella, therefore, the main aim will be based on the science developments, rather than on political aspects. This group could also integrate members of the Regional Seas Convention. A joint North Sea Monitoring Group could (NSMG) have the following key priorities:

- 1) Decide on key priorities depending on the science to be tackled. Representatives of the NSMG should liaise with existing groups under the Regional Seas Convention and other Institutes. This could help to reduce the political bias and helping to complement current responsibilities. The NSMG could be done under different thematic areas (e.g. Hazardous Substances and Eutrophication-HASEC, Environmental Impacts of Human Activities-EIHA, -Biological Diversity and Ecosystems-BDC and others)
- 2) There is a mandate of policies at present and limited amount of money to monitor different needs. A decision on splitting which monitoring will fit one or multiple purposes, could help to maximise the effort needed and help to prioritise what is needed (e.g. adopting a risk based approach to maximise the work and resources);
- 3) Adopt realistic operational practices to support the aims and delivery needed;
- 4) Sep- up an independent evaluation panel (e.g. science audit approach-get countries with similar expertise to QA the work and provide recommendations);
- 5) Set a clear achievable goal over time that can help to work and dedicate time, effort and science to achieve the dedicated goal. For example, this could be added as a dedicated objective with a realistic time frame (e.g. SMART objective) for all of the thematic groups working under the Regional Seas Convention, helping them to over time define and accomplish joint monitoring.

Session 3: Data sharing

Current drivers (e.g. national monitoring assessments, OSPAR, EU Commission) associated with sharing information. Additionally, there are also multiple systems dealing with data storage, which can result in duplication of effort, inconsistencies between systems, lack of knowledge, poor data retrieval and multiple standards.

Data architecture, mainly associated with funding is also an issue as there is a limited level of resources to support data storage. There is a need for a single set of standards (e.g. Erf3.2) and agree on the mechanisms to be used during data collection and reporting. There are several documents describing QA and addressing the issues

associated with quality, which make difficult to follow one single document that may act as a dedicated and detailed guidance. There is also a suite of parallel data bases which can create issues when reporting data sets and undertaking further analysis.

There are currently more demands to move towards the existing EU data-bases (e.g. EMODnet), but some of these are still under development and there is a need to invest significant time and effort to create efficient tools to display and interrogate the information available.

Institutional sharing of information, some organisations will have time-series associated with the monitoring and these will provide a further understanding on the changes and variability presented on these systems. Often there is low willingness to share data sets with more tendency to share interpreted outputs (e.g. maps and plotted data), which only provide limited access to information, and issue when data sets need to be added to a wider analysis of a given area or sub-region. One of the issues associated with sharing raw data could be that the data has been collected with a single purpose, therefore, trying to use the data over different contexts could present issues. Another aspect to consider when sharing data is that the data may it been transformed or treated during interpretation and if the raw data is provided there is a danger that these steps could be omitted, making the data sets incompatible for wider assessments. Some recommendations to consider when sharing data will be to adopt a *'Memorandum of Understanding-Mou'* between Institutes, by adopting this agreement, then there will be a joint action to share data for further interpretations. A way forward could be that some Institutes could adopt this way of working and review the benefits over a set period of time. These types of approaches could start on dedicated assessments and could be further co-ordinated under OSPAR direction, helping to provide an example of best practice for MSFD assessments.

Suggestions for consideration when dealing with data sets:

- 1) Adopt the shared economy solutions, try to use and support on good data base, so all of the efforts are concentrated into one site (e.g. main data bases: ICES Datras, EMODnet, ect.);
- 2) MS/Institutes often try to re-invent the wheel and create a new system, which often will have a short life (e.g. often during the duration of a project);
- 3) Develop and share data standards and protocols;
- 4) Some of the raw data sets and data products (e.g. maps of indicators), could be used as a way to display and disseminate the current data coverage. These products can also be used to illustrate sampling gaps and could help to further define areas that will need to be targeted (e.g. due to pressure or an emerging risk);
- 5) There are many parallel data bases available (e.g. ICES Data Centre, EMODnet, Emeco, others), which does take time and these data bases are not connected. Another aspect is that on a national level, there are also data bases that hold data sets from individual countries. Therefore, a clear suggestion will be to decide on *'fit-for purpose'* data base, which can be developed with the view to host dedicated monitoring information (for metadata and raw data holdings). This data base can be also supported by all parties that have to undertake regional assessments. There could be a clear benefit to submit and extract information helping to support planning during monitoring and undertake their assessments when looking at wider areas;
- 6) Encourage and promote transparency to what happens to data submissions;
- 7) Consistency of data (from different sources, e.g. industry);

- 8) Co-ordinate consortiums and ensure that long-term commitments for funding are available to ensure the project gets established and it is able to adapt to the current demands and improve in time with the additional demands as there are new requirements needed (e.g. small scale assessments, risk-based assessments, regional assessments, sub-regional assessments) opportunities to ensure that data projects are long-term;
- 9) A combination of data manager, scientist and programme manager, should work together to ensure that there are dedicate the efforts to store, QA/QC the data and provide data sets that are 'fit for purpose', depending on the level of investigation required (e.g. exploratory work, R&D, risk-based assessments, etc.) ;
- 10) Once the data is stored an advantage will be to undertake statistical analysis of the data available. This exercise will help to an understanding of the information available and identify the further gaps that will need to be target to comply with the aims of monitoring and assessment required.

Session 4: Ways of working in the future

During the discussions there were several recommendations that were presented as ways of improving the current monitoring work/relationships (e.g. nationally and internationally). These ideas are summarized below.

Process approach, there will be a need to identify the major issues that monitoring needs to concentrate on. One particular aspect to dedicate efforts will the associated with pragmatic risk based approaches. This method will help to target the necessary assessment, maximising the available resources. Some of the dedicated work under OSPAR has made some progress in identifying the work that needs to be prioritised under different thematic groups. This process could also further developed adopting a series of priorities regional areas to be at most risk.

Geographic approach, this method could be based on risk based approach and primarily, adopting a co-ordination based on a bottom level approach. A strategic way, will be to prioritise which areas will be assessed first and by which level (e.g. priority setting approaches), depending on the level of risk or pressures in a particular system. The use of examples and case studies could then be used to define trends, share resources and some countries may adopt dedicated ways of working together (e.g. bilateral approach) to share the cost of monitoring.

Consider existing funding models of joint monitoring, the example of funding model through (DFC- for fisheries) could be also further analysed and assess if aspect of environmental monitoring could be added to the annual fisheries monitoring as a long term commitment rather than solely an opportunistic approach. If a fisheries-environment monitoring could be better joined up, then there may be better funding mechanisms to support a robust monitoring design for fisheries and environment on a regional level. Therefore, joint planning could be supported and reported regionally. The Regional Seas Convention could also provide further support and steer during planning of joint monitoring for a dedicated area.

Coordination on top-level, there are clear issues related with the scale in current monitoring is done. Nationally, most countries undertake small scale monitoring. During assessments, these small scale monitoring data sets to be made comparable with other data sets, these will have to be 'scale-up' for achieving a Regional approach. The Regional Seas Convention could be potential vehicle to support these discussions and agree on a more co-ordinated methodological approach, helping to reduce biased and analytical errors during data analysis.

Thematic monitoring, there is a need to join up existing groups based on different thematic areas from ICES and the Regional Seas Convention. There is a wide range of birds, habitats, floods, fisheries, benthos and coastal processes. At present most of these groups work on a dedicated ecological component and it is imperative that these assessments are joined up to achieve an ecosystem approach to manage these resources. These groups could also have support from an external group of experts (e.g. ICES). This group of experts could provide beneficial feedback on methodology, collection protocols and overall monitoring. The idea of storing monitoring plans in a data portal (e.g. UKDEMOS, EDIOS) could be useful to retrospectively ascertain the aims and the results of the monitoring effort employed at a given area. These monitoring plans could help to inform future practices.

Creation of vessels users group, this could be done on a regional approach (e.g. starting on a dedicated geographical area) and could make some progress by looking at the bilateral capacity (e.g. UK and Belgium) and sharing some aspects of monitoring (e.g. number of stations, gear deployed and overall data outputs). There could be some dedicated monitoring conditions across institutes (e.g. sharing the cost of the vessels and both institutes gathering access to the raw data and outputs). This way of working can also be supported bilaterally during joint planning and creating maps with dedicating sampling stations, therefore enabling both parties to share the money and data benefits during monitoring surveys.

Standardised monitoring protocols, MSFD CIS and OPSAR⁸ are already working towards the integration of monitoring practices. A further step will be to adopt an independent groups of scientists and could be providing audits and using the 'MSFD ready' accreditation can be a certification of an additional supportive terminology, covering aspects of methods and standards compliant to the requirements of the MSFD. There could also be benefits from using industry data sets, which can also be collected under the same 'MSDF ready standards', benefiting industry (e.g. supporting license conditions) as well as monitoring colleagues (dedicating efforts to target monitoring) and policy colleagues (informing of their needs with regards the science needed to underpin decisions), subsidy sampling efforts and allowing for additional collection of monitoring data.

An independent monitoring team, the creation of a body of experts, which could audit institutes and act as a 'critical friend' (e.g. bilateral approach initially to test the pilot working style) could help to make some cost efficiencies as well as promoting better co-ordination and QA the overall monitoring outputs.

Creating a manual for monitoring and assessment, there are many documents available, but there is not a single up-to date document on current monitoring tools, methods, analytical approaches. Some sections could provide a series of case study examples with national and international examples and co-ordinated working groups. A dedicated manual could promote better co-ordination by providing details on efforts, experts and economics associated with the monitoring.

Survey of expertise, a SWOT (strengths, weaknesses, opportunities and threats) analysis could be carried out to assess national, international, regional and sub-regional expertise. This information could then be stored under a matrix of monitoring capabilities. This matrix of skills could then be use train other Institutes or help to QA/QC current monitoring.

Prioritisation of survey areas and subjects to consider under joint monitoring, considering wider assessments based on the costs and benefits. The results can then be considered together and can be a starting point to promote joint monitoring practices. For emerging topics, such as marine litter and underwater noise, where little or no monitoring is in place, there is an opportunity to set up *joint* monitoring from the beginning. For example, in the OSPAR ICG Noise a proposal has been made for a joint ambient noise monitoring programme for the North Sea; actual

⁸ http://ospar.org/html_documents/ospar/html/initial_ospar_contrib_eu-cis_november_2013.pdf

implementation of such a programme is dependent on simultaneous availability of budgets in the participating MS's and could be promoted by EU co-funding programmes.

Build an International co-ordination group, OSPAR are promoting existing coordination. Additionally, there could be small group that could work alongside OSPAR and this group could develop plans and allocate money, once an agreement and monitoring plans are available. This group could share the aims of the survey, methods (how), areas (considering spatial scales- where) and timing (temporal scales-when) the work will be done. For example, the UK and Ireland could jointly agree on monitoring and share data across for assessment. This small level approach could help to tackle dedicated areas and providing quick outcomes. Some countries could adopt a high level agreement (Memorandum of Understanding -*MOU's*) could help to divide up the work, add value to surveys and maximise the use of vessels.

9. Assessing level of cooperation in monitoring

During both workshop, there was a mixture of participants with different level of expertise and decisions during the overall monitoring process. For example, scientists and monitoring experts/programme managers made dedicated decisions on the more operational aspects of the work (e.g. geographic area, best sampling method, best coverage, resolution, analytical methods). Whilst policy makes were able to use this scientific information as advice to inform decisions. Therefore, a polling exercise, to canvass opinions from different levels, based on the current and future monitoring was undertaken by participants during both workshops.

A good example of co-ordinated monitoring is through the International Bottom Trawling Survey (IBTS)⁹. The IBTS started is undertaken during January/February since about 1970. Part of this survey, has also station observations of environmental measurements which has resulted in a most comprehensive fish and environmental dataset of the North Sea. The IBTS coordinates fishery-independent multi-species bottom trawl surveys within the ICES area. These surveys aim to provide ICES assessment and science groups with consistent and standardized data, helping to undertaken spatial and temporal analysis, considering: (a) the distribution and relative abundance of fish and fish assemblages; and (b) of the biological parameters of commercial fish species for stock assessment purposes (more details on history of the survey, dedicated gears, area and assessments are available via ICES IBTS protocols)⁵.

The IBTS example was explained to the participants. Overall, each country has an institute that undertakes part of IBTS. The IBTS is composed by scientist from different countries. The sampling gears, areas and approaches are all standardised and the data is stored on a centralised data repository (ICES Datras). The data is then analysed by a co-ordinated analysis and assessment, for the relevant ecoregion, in an ICES expert group, with participation of all relevant countries (e.g. WGNSSK Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak).

The outcomes of the scientific analyses are then communicated to an advisory group supported by ICES composed by senior scientists and science managers under a National and International fora. The overall messages are then presented to National Ministers, EU Commission and Council, which decide on the TACs/quota. This information is then reported to the Fisheries industry. The importance of this whole process is the clear boundary where the science advice feeds onto the political decision (Figure 2).

Figure 3 depicts the structure and responsibilities of scientific advice and policy decisions in marine environmental assessment. There is clearly no sharp delineation between policy and science as compared to the fisheries assessment process outlined in Figure 2.

⁹ <http://www.ices.dk/sites/pub/Publication%20Reports/ICES%20Survey%20Protocols%20%28SISP%29/SISP1-IBTSVIII.pdf>

JMP (Fisheries)

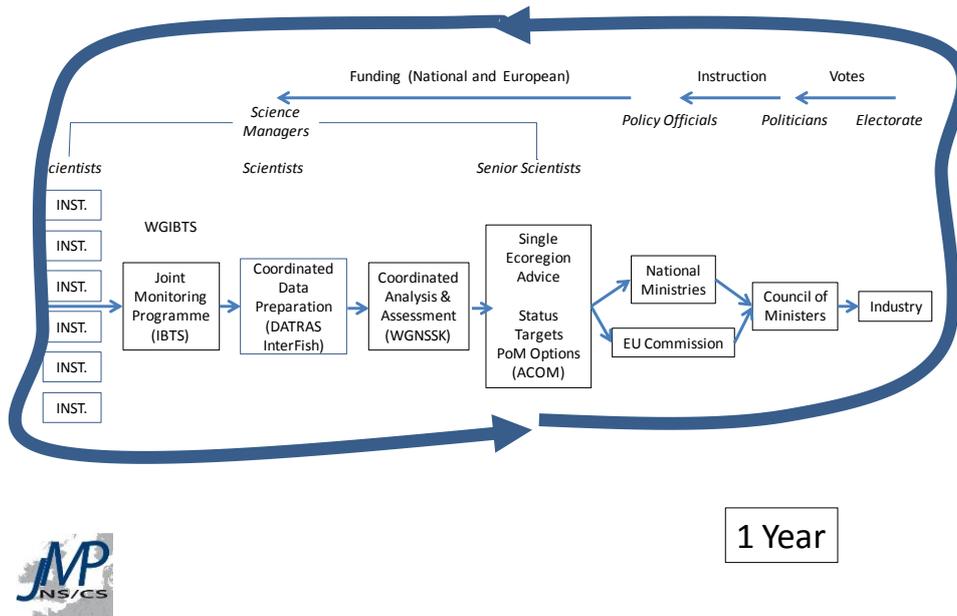


Figure 2: A summary to illustrate the overall joint monitoring planning and decisions considered at ICES for the International Bottom Trawling Survey- IBTS. The image shows where the science interaction (left side of the image) and policy level (right hand side of the image). The science evidence is used to make decision on quotas. The overall process is done over 1 year period. ©Bill Turrell.

	FUNCTION	UK	ICES	Regional Seas Conventions (e.g. OSPAR)	European Commission
Policy Officials Science Managers	Strategic Direction	MSCC	ICES COUNCIL	OSPAR COMMISSION	MARINE DIRECTORS
Policy Officials Science Managers	Operational Governance	MARG	ICES Bureau CSG-MSFD	CoG HOD	MSCG CGBN Habitats Committee ORNIS
Policy Officials (scientists)	Strategic Science Leadership	Funders Group	ACOM SCICOM	HASEC BDC EIHA	WG-MSFD WG-GES DYKE WG-ESC
Scientists Policy Officials	Operational Science Leadership	HBDSEG CSEG OPEG UK-IMON	SG-EPD SG-EPI SG-IEA SG-IEOM	ICG-COBAM ICG-MSFD ICG-MPA ICG-ML	Project Coordination Group EEA
Scientists	Development and Implementation	Sub-Groups	ICES Expert Groups ICES Study Groups ICES Workshops (e.g. WGECO, WGBIOV, WGISUR, etc.)	See above OSPAR Working Groups (e.g. ?????) ICG-ML technical subgroup	EU working groups EU Framework Projects (e.g. STAGES, Integrated Survey Bids, e.g. NS/CS)

Figure 3: Initial summary overview of scientific advice and policy making in marine environmental management at national and international level. In contrast to the advice cycle for fisheries, there is interaction between policy and science at all functional levels. ©Bill Turrell

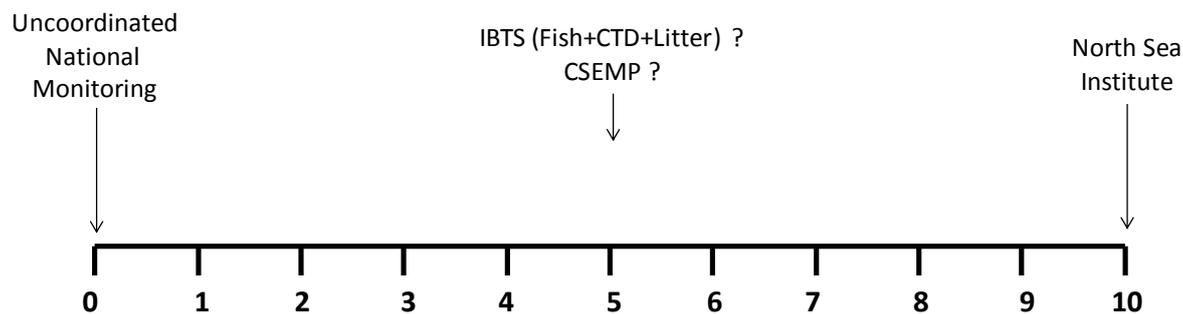
A second distinction between the fisheries and environmental assessment process is the level of international collaboration. The Common Fisheries Policy and its Data Collection Framework require extensive international collaboration in the entire management cycle from indicator and target setting to monitoring, assessment and policy decisions based on the assessment. Under the DCF European co-funding leads to harmonisation of monitoring and assessment procedures between Member States. In environmental marine management legal obligations of the main drivers at EU level (MSFD, WFD and BHD) are targeted at individual MS, using their national budgets. International coordination is organised in Regional Seas Conventions, with less stringent requirements for harmonisation and cross-border collaboration. Assessments are performed partly at the RSC level, e.g. OSPAR's upcoming Intermediate Assessment 2017 for the MSFD, using common indicators for a part of the assessment of GES, but still based on nationally coordinated monitoring. The monitoring of common indicators follows OSPAR guidelines aiming at comparability across borders. National reports to the European Commission will use additional indicators applicable to national waters. Joint targets and baselines for common indicators are still under consideration in OSPAR.

Challenging Statements for consideration:

- The confusion of roles of scientists / science manager / policy official / politician in the MSFD process is a barrier to Coordination, and hence Joint Monitoring
- Policy Officials should not care how assessments are reached, they just need the advice (i.e. how far off GES are we?)
- Policy Officials are the wrong sector to discuss Joint Monitoring with. We need the Science Managers (Budget Holders)
- Politicians, and their Policy Officials, would be more comfortable with National Monitoring
- Barriers to Joint Monitoring will only be brought down with carrots (i.e. cost savings) and sticks (i.e. infraction)
- Industry, and the electorate, don't care if we are at GES or not – to them Joint Monitoring is an irrelevance

The polling exercise included a scale of cross-border collaboration and questions on the current and potential level of collaboration (Figure 4). The answers to these questions were numbers between zero and ten. The opinions of the workshop participants (workshop 1, n=19) and (workshop 2, n=18) were based on the current experiences and examples of how monitoring and assessment are organised from the perspective of scientists, policy makers and monitoring programme managers.

Workshop Joint Monitoring Programme (W-JMP)



My Sector (e.g. Policy / Science / Manager)

1. What level of “Joint Monitoring” would be politically acceptable ?
2. What level of “Joint Monitoring” would be cheapest ?
3. What level of “Joint Monitoring” would be scientifically most robust ?
4. Where on the scale is MSFD monitoring in the North Sea / Celtic Sea today ?

Figure 4. Scale of international collaboration ranging from national coordination to a joint North Sea wide Institute. The box contains questions that were raised in the polling exercise.

The overall results from this exercise are summarised in Figure 5 (upper panel: workshop 1; lower panel: workshop 2), these are the overall scores from the participants. Individual questions and responses are summarised in the sections below:

Question 1: What level of ‘Joint Monitoring’ should be politically acceptable?

The overall results indicated that over the two workshops, all groups (scientists, policy makers and managers) agreed that a level of ‘Joint monitoring’ close to the current IBTS should be politically acceptable. The overall scores showed that a level of co-ordination such as the IBTS could be a good model to support an effective method of joint co-ordination.

Question 2: What level of ‘Joint Monitoring’ would be the cheapest?

Overall responses indicated across both groups indicated that a level of co-ordination close to a ‘North Sea Institute’ will be the cheapest option for marine monitoring.

Question 3: What level of ‘Joint Monitoring’ would be scientifically most robust?

The results showed a tendency that the majority of colleagues agree on a more centralised and better co-ordinated North Sea Institute type of approach for some aspects of joint monitoring. By adopting this working method, this could help to agree on specific protocols, collect data with similar methods and better data integration. However, a remark was made that scientific robustness also requires a healthy debate between independent experts.

Questions 4: Where on the scale is MSFD monitoring in the North Sea/Celtic Sea today?

Overall over the two groups, clearly this was the question with the lowest scores. There is limited to no cross-border co-ordination in MFSD monitoring in the North Sea and Celtic Sea today.

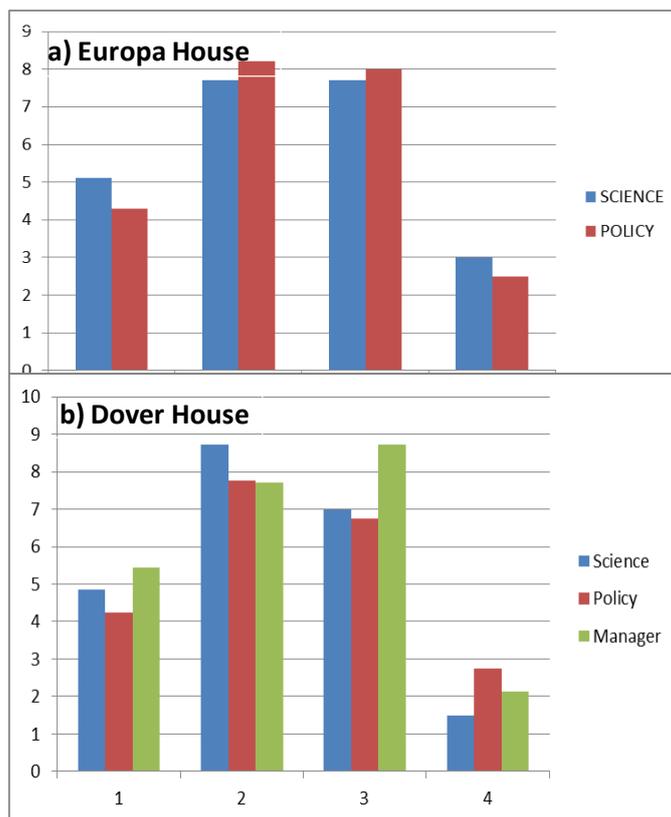


Figure 5: Overall summary of results from the questions 1-4 on the level of monitoring required. Values are: 0= national coordination only; 5=CSEMP/IBTS and 10= North Sea Institute.

These scores obtained during this exercise are only an initial stage to understand the position and the level of effort required to achieve joint monitoring. These responses are only an initial stage with different expert groups. Some of these responses will need further assessments (e.g. time, effort, geographic area, different levels of resources) and consideration (e.g. platforms, methods, personnel involved). For some of the new Descriptors under the MSFD (e.g. noise and litter), there will be much easier to align the current monitoring as these are programmes where some of the methodologies are new and similar approaches are being jointly developed.

A marine litter case study developed by Cefas showed the need for coordination of monitoring in the case of determination of trends of litter on the seafloor. A detection of a 10% change over 5 or 10 years is unlikely without very large sample sizes. However, 30% and 50% changes can be observed over 5 or 10 years. This implies that by combining marine litter monitoring efforts and data between MS operating in the same region, a North East Atlantic monitoring programme for marine litter on the seafloor could be put in place (“together we stand strong”). This programme will monitor more stations and gather a larger set of data than possible by individual MS, allowing for a

North East Atlantic marine litter assessment (comparable to the contaminant monitoring under OSPAR MIME) with high power to detect trends or impacts of measures (see Annex II for more details on this case study on marine litter).

10. General Conclusions & Recommendations

Within this project we have identified existing examples of joint monitoring between institutes as well as between scientific disciplines, and have described some of the scientific and organisational challenges encountered. Building on these examples and using the outcomes of the analyses under Activity C, the following section presents a selection of policy actions that could be initiated in the short term to facilitate development of joint monitoring:

Challenge	Options
There are numerous separate international groups (e.g. under ICES, OSPAR, European Commission) set up to advise on strategic direction or determine monitoring needs, but very few groups coordinate (multi-party/multi-discipline) operational programming of monitoring	<p>Improve interaction between the policy/science needs and the operational programming, by:</p> <ul style="list-style-type: none"> • Letting overarching multi-party coordination groups (cf. Dogger Bank Steering Group monitoring sub-group, Irish Sea), of scientists, policy makers, stakeholders, develop, implement and maintain long term plans for monitoring (incl. data storage, data sharing, analysis and assessment) • Use the ICES Survey Working Group model to bring scientists together to develop and refine monitoring and assessment methods, taking into account policy interests
Different national remits, funding mechanisms and priorities in marine monitoring might lead to competition between monitoring institutes rather than joint monitoring	<p>Focus initially on areas of monitoring where greatest gain can be obtained (e.g. seas where a number of countries are involved, e.g. benthos in the North Sea)</p> <p>Arrange long term solutions such as a central funding source across countries with incentive to cooperate (e.g. EU Data Collection Framework method of funding collaborative data collection)</p> <p>Organise multi-party vessel/monitoring platform groups to facilitate sharing of vessels/platforms between scientific disciplines and/or countries. Eurofleets might provide a framework for this, although it may not fit all needs</p>
Processes to obtain permits to sample in other national waters varies with country and needs to be planned well in advance of the actual sample/data collection	<p>Standardise, simplify and speed up the current international permit process for such cross-border sampling across EU Member states</p> <p>Provide clear protocols for each Member State on regulations concerning monitoring by foreign vessels and crews</p>
Information on national monitoring is not easily accessible, restricting spontaneous joint	Use the metadata database of EU Members States national monitoring programs developed in this project

<p>monitoring. Monitoring priorities often vary with time and political landscape, which makes integration and agreement of joint monitoring between countries difficult</p>	<p>to find the national monitoring contact persons</p> <p>Develop mechanisms to maintain and update this metadata database</p> <p>Develop mechanisms to share forward planning for monitoring surveys over appropriate time-frame (several years), to facilitate vessel availability. Consider development of a real time survey vessel information system, cf. BALSAM</p> <p>Arrange long term solutions such as a central funding source across EU Member States with incentive to cooperate (cf. EU Data Collection Framework method of funding collaborative data collection)</p>
<p>It is both a scientific and a political challenge to get agreement on the appropriate common monitoring methods to use. For example, organisations may be unwilling to change their methods to accommodate the needs of another country or scientists may be unwilling to adapt their existing methods which might disrupt long time-series of data</p>	<p>Consider improved multi-party integration from the start, preferably during the planning of work</p> <p>Develop mechanisms to share forward planning for monitoring surveys over appropriate time-frames</p> <p>Develop a portal for shared monitoring protocols, including periodic inter-calibration exercises</p> <p>Establish conversion factors to maintain time-series despite changes in methods</p>
<p>Reporting under many European Directives is a Member State responsibility, there is a will to cooperate, but not a very strong driver to force regional cooperation</p>	<p>Clear guidance on assessment and reporting, taking account of regional differences, in line with the set priorities of the Directive</p> <p>Further explore costs and benefits of joint monitoring compared to business as usual</p>

11. References

EU. 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). <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF>.

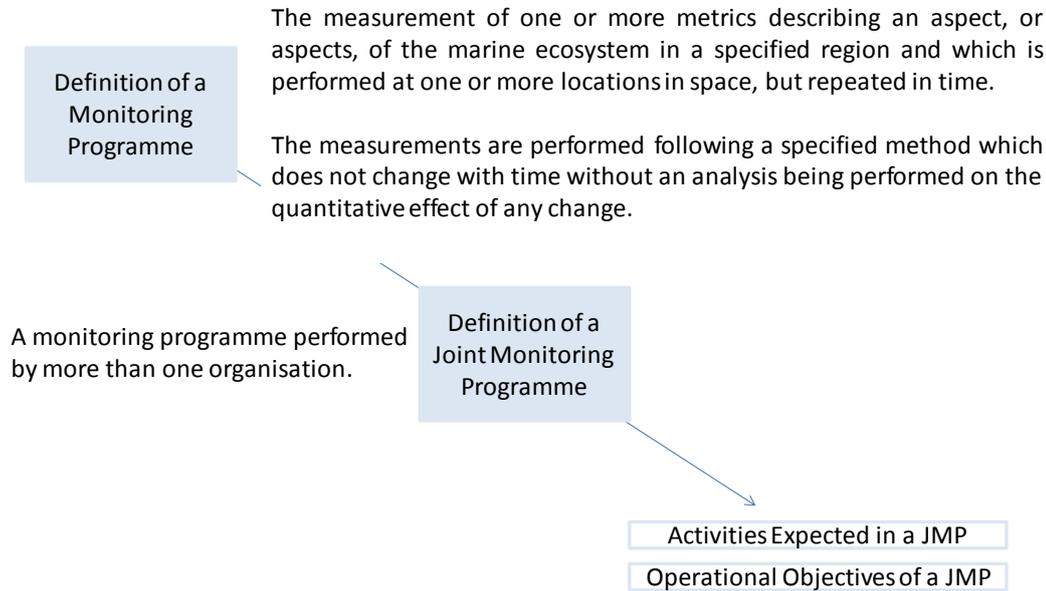
Borja, A., Elliott, M., Carstensen, J., Heiskanen, A.-S., van de Bund, W. (2010). Marine management – towards an integrated implementation of the European Marine Strategy Framework and the Water Framework Directives. *Marine Pollution Bulletin* 60 (12):2175-2186.

Elliott, M. (2011). Marine Science and management means tackling exogenic unmanaged pressures and endogenic managed pressures-A numbered guide. *Marine Pollution Bulletin*, 62: 651-655.

Van Hoey, Gert; Borja, A.; Birchenough, S.N.R.; Degraer, S., Fleischer, D.; Magni, P.; Muxika I.; Reiss, H.; Rumohr, H.; Schröder, A.; Zettler, M. (2010). The use of benthic indicators in Europe: from the Water Framework Directive to the Marine Strategy Framework Directive. *Journal Marine Pollution Bulletin*, 60 (12):2187-2196.

12. Annex I- Definition of Joint Monitoring

The JMP project team agreed on a Joint Monitoring definition. The definition was presented by Bill Turrell on behalf of the JMP consortium as:



Activities Expected in a JMP

- *shared platforms*
- *shared equipment*
- *joint training programmes*
- *joint planning meetings*
- *joint programme management*
- *inter-organisation personnel exchange*
- *inter-organisation calibration studies*
- *shared data infrastructure (e.g. databases)*
- *shared assessment procedures*
- *joint assessments*
- *joint reporting*
- *joint funding mechanisms*
- *joint resource allocation*

Possible Operational Objectives of a JMP

- *to extend the spatial or temporal extent of measurements using the same resource allocation among JMP members*
- *to increase the number of metrics measured using the same resource allocation among JMP members.*
- *to increase the precision of a metric using the same resource allocation among JMP members*
- *to reduce the resources needed by JMP members to measure an existing set of metrics*

13. Annex II- Examples of Joint Monitoring

Example 1 - International co-ordination: The Dogger Bank Special Area of Conservation

An example of international cooperation to develop integrated monitoring undertaken by the Netherlands, UK and Germany. (Provided by Charlotte Johnson JNCC, UK and Vincent van der Meij Ministry of Economic Affairs, NL)

The Dogger Banks (DB) is protected under EU Habitats Directive for its sandbank habitat (~25,000km², which is ~4% of the North Sea) (Figure I.1-a). The site itself consists of three separate Special Areas of Conservation (SACs) identified by UK, the Netherlands and Germany. Each MS is responsible separately for defining conservation objectives and ensuring that site integrity is maintained and/or restored. The International Dogger Bank Steering Group (DBSG) is composed of Ministry representatives and scientific advisors and was set up to agree management objectives for the transnational site (e.g. restore habitat, damaged due to bottom fishing methods due to trawling) (Figure I.1-b). The DBSG and International stakeholder group (The Common Fisheries Policy -CFP North Sea Regional Advisory Council) developed and agreed fisheries closures with ICES to protect and restore sandbank habitat. The DBSG is also responsible for monitoring the site, with the aim of assessing the effects of the fisheries management measures (e.g. closure of parts of the site to assess the effects resulted from bottom fishing methods).

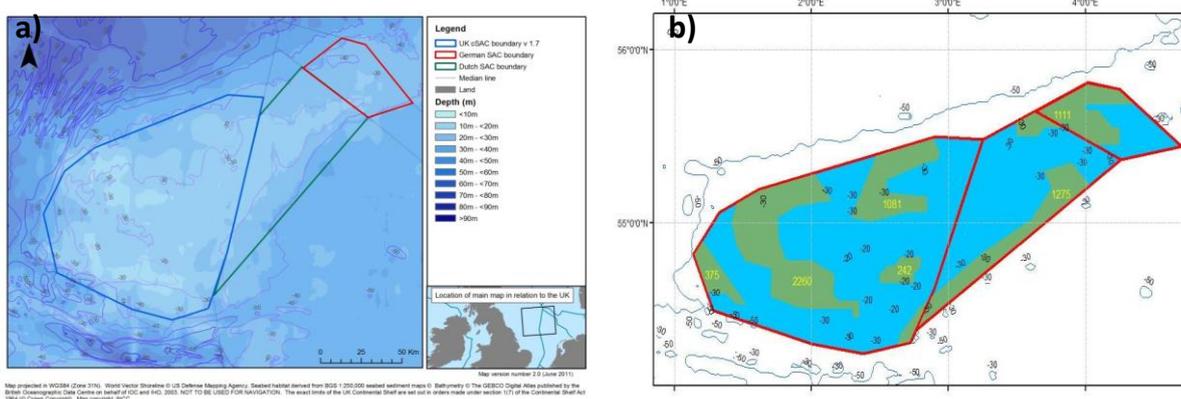


Figure II.1: Images showing: a) the location of the Dogger Bank SAC and b) proposed fisheries closure in the area.

Integrated lessons for monitoring

Challenges:

- In the case of the Habitats and Birds Directives, there are no *requirements* to integrate monitoring across MS.
- Each MS has developed their own national monitoring plan for their part of the SAC.
- Different parameters measured, gear types, frequency of monitoring, seasonal timing, which makes comparison of data across the site difficult.
- Availability of funds and timing for monitoring surveys are set nationally – not agreed between MS.
- Funding and the programme for agreeing joint monitoring is *ad hoc* – need a lead partner to drive a joint programme.

Benefits:

- Under the current drivers for MSFD there is now the legal framework to integrate monitoring
- Setting up DBSG provided a beneficial approach to foster international cooperation.
- DBSG agreed a policy of coordination of monitoring between MS.
- Setting up a Monitoring sub-group gave focus for scientific discussion on common monitoring objectives and how to achieve common monitoring methods/strategies (more work to be done!).
- Focus on one (large) site, for one habitat (5 sub-types), simplifies discussion and facilitates agreement on how to achieve joint monitoring, as a pilot.
- Need to explore if/how to do joint assessments of status using different monitoring data from each MS.

Example 2 – thematic integration: Marine litter on the seafloor

Marine litter, plastics in particular, is accumulating in the marine environment and can be found on beaches, in the water column and on the seafloor in oceans all around the world. It is the result of unsustainable consumption and production patterns, poor waste management and the lack of public awareness. Marine litter is an increasing threat to the marine environment and human health. It has cross border impacts not only on the environment, but also on a wider socio economic level. The EU is addressing the problem of marine litter through the MSFD, which requires MS to monitor the state of our seas and take the measures needed to reach or maintain its 'good environmental status' by 2020. On a more regional level, marine litter has been recognised as a growing issue by OSPAR who developed indicators and a regional action plan to tackle this issue. One of these indicators is focussing on marine litter on the seafloor.

Little is known about the extent of the problem in the North Sea and Celtic Sea regarding litter distribution and its influence on the seafloor. Cefas has been collecting marine litter data on the back of existing fisheries and environmental cruises since 1992 (e.g. International Bottom Trawl Survey -IBTS) and developed an approach towards assessing this type of marine litter data. This approach will be presented for adoption as an OSPAR Common Indicator to assess benthic marine litter in future.

A quantitative assessment of debris present on the seafloor was carried out by Cefas in the past for the North and Celtic Sea, using existing environmental surveys (Figure II.2). The dominant type of debris was plastic, but other types were present. When designing a monitoring programme it is important to consider its power of detection. As a design criterion Cefas uses the ability of our surveys to detect a trend over a ten year period with 90% power. The power of the design is the probability that it will detect the difference we are interested in. In the case of Cefas (UK), depending on the availability and affordability, a selection of cruises is made to cover the UK waters. Cefas adopted a random-stratified approach which will allow inferences to be made about the whole stratum rather than the fixed sites.

Given that some of the surveys are currently not random samples, we have chosen to give illustrations of power for two campaigns that have reasonably good geographical spread of the area they cover (i.e. not clustered around the coast like the for example the DBTS survey).

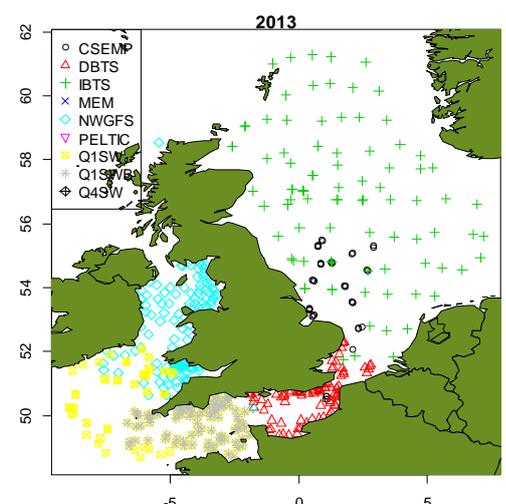


Figure II.2: 2013 Cefas Marine Litter sampling

We have used:

- IBTS survey to represent the Greater North Sea
- Q4SW survey to represent the Celtic Seas.

Clearly, neither of these surveys covers the whole of their areas. However, they do cover quite a large proportion of the area. For now, we expect that power from the IBTS and Q4SW surveys should give a reasonable guide. The power plots for the Greater North Sea surveys are shown in the figure below (see Figure II.3 and II.4). We can see that the power is poor for the 10% increases. However, for the 50% increases, power is high. For the 10 year duration, power is over 90% (i.e. there is a 90% chance that the litter trend would be detected) even for a sample size of 40. For the 5 year duration, power reaches 90% when sample size is 80.

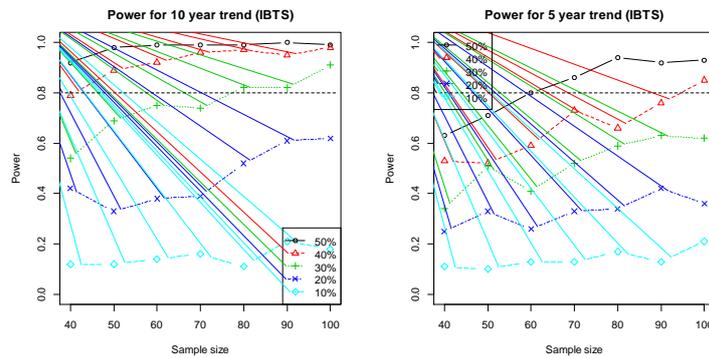


Figure II.3. Power for IBTS surveys (representing Greater North Sea).

Power for the Celtic Seas surveys is similar (marginally lower) to that for the Greater North Sea.

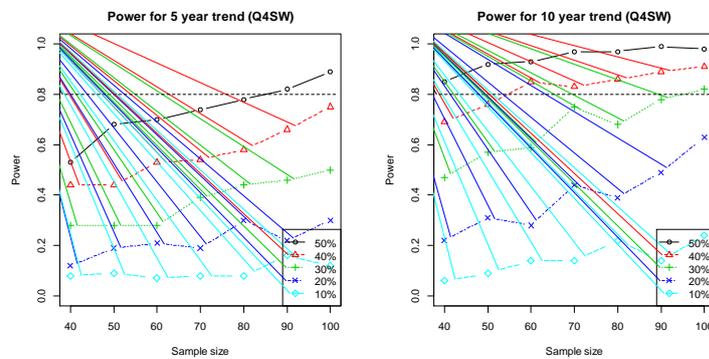


Figure II.4. Power for Q4SW surveys (representing the Celtic Seas).

14. Annex III– Agendas and attendees (Workshops 1 and 2)

Workshop 1:

Agenda Item 0

ICG-MSFD(2) 14/00/03

English only

Joint Monitoring Programme North Sea & Celtic Sea (JMP NS/CS)

Workshop Plan for Activity D with member of the JMP and

Group for the Implementation of the Marine Strategy Framework Directive (ICG MSFD)

London (UK): 10-11th September 2014

Agenda

Presented by Dr Silvana Birchenough (Cefas, UK)

Start of meeting: 09:00-16.00 Wednesday 10th September 2014
Close of meeting: 08.30-13:00 Thursday 11th September 2014
Venue: Europa House 32 Smith Square, London, SW1P 3EU

Background

The successful and cost-effective implementation of the EU Marine Strategy Framework Directive (MSFD) depends on regional cooperation between EU Member States and other countries. This project aims to build a strong network between all institutions that are responsible for monitoring, covering the areas of fisheries and environmental monitoring. This 18-months project is coordinated by The Netherlands Ministry of Infrastructure and the Environment/Rijkswaterstaat).

The consortium aims to work towards lasting cross-border cooperation for current and future implementation of the MSFD. The aim of this pilot project is to find ways to integrate and maximize marine monitoring efforts of the partner organizations and to develop a proposal for a joint monitoring programme for the North Sea and for the Celtic Sea.

The JMP NS/CS project focuses on specific areas for co-operation:

1. Monitoring data and information management
2. Multi-use of monitoring platforms (ships, planes, buoys...) and combining platforms (Activity C)
3. Planning tools for adequate programmes that delivers MSFD assessment needs (Activity E)
4. In-depth investigation of the potential for further co-operation for number of common indicators (case studies).

The current workshops, under Activity D, will mainly focus on points 1 and 4.

This workshop is part of activity D and aims to explore the current options for integration as well as discussing the current challenges faced by all Member States, when considering the requirements to comply with MSFD.

Most of the discussions will be based on the selected case studies from this project. There will be an overview of the project and specific information targeted to the case studies. The four case studies are: i) Eutrophication (Chlorophyll a) ; ii) Demersal elasmobranch iii) Benthic multimetric indices and special attention to iv) Marine litter (Background and information on case studies is provided in Annex I)

Agenda Day 1: 10th September 2014.

Morning Chair: Bill Turrell

09.00-09.15 Welcome and introductions (Silvana Birchenough, Activity D leader, JMP project)

09.15-09.30 Definition of Joint Monitoring Programme (Bill Turrell, Activity I lead, JMP project)

09.30-09.45 Overview of the Joint Monitoring Project (Lisette Enserink, JMP project co-ordinator)

Short overview presentations (10 minutes +5 minutes questions):

09.50-10.05 Activity A-B (Steven Degraer, RBINS)

10.05-10.15 Activity C lead (Ralf van Hal, The Netherlands)

10.15-10.25 Activity E lead (Francisco Marco-Rius, TiSF)

10.30 -10.40 Aims of the workshop to support Activity D (Silvana Birchenough, Cefas)

Initial questions:

i) What are the expectations from this workshop?

ii) What would you do to improve the current monitoring practices?

11.00-11.30 Coffee break and group photograph

11.30-11.45 Truly Integrating Monitoring for Ecosystems (TIME) Project (David Righton, Cefas)

11.45-12.30 Overviews of selected case studies:

CS1: Chlorophyll (Hans Ruiten/Matthew Gubbins)

CS2: Elasmobranchs (Marco Ruiz/Ingeborg de Boois/Anne Sell)

CS3: Benthic multi-metrics (Gert Van Hoey/Hans Ruiten/Steven Degraer)

Special attention to Marine litter (Thomas Kirk Sørensen/Thomas Maes)

12.30-13.30 Lunch (sandwiches and fruits provided)

Afternoon Chair: Silvana Birchenough

13.30- 15.00 World Cafe approach (http://en.wikipedia.org/wiki/The_World_Caf%C3%A9.) covering 4 main topics across different tables (see main topics below) to target policy questions from case studies (see Annex I for general background and policy questions). Facilitators: Stephen Malcolm (Cefas/Defra), Lisette Enserink (RWS), Bill Turrell (MSS) and Jo Foden (Cefas/Defra)

Main topics for discussion:

1. Development of common indicators and targets
2. International co-ordination
3. Multi-use of monitoring platforms
4. Data availability, reporting and assessment

15.00-15.30 Coffee Break

15.30-16.00 plenary session (each table leader to provide main messages)

16.00 End of Day 1.

17.00-19.00 JMP planning team discussion

Day 2: 11th September 2014.

Morning Chair: Lisette Enserink

Plenary session: summary of main messages from Day 1 (Silvana Birchenough)

Definition of gaps and needs (subgroups dialogue)

11.00-11.30 Coffee break

Discussion: what does the JMP need from policy makers? And: what do policy makers need from JMP?
(Bill Turrell)

12.00-12.30 Final summary and timeline for workshop report/ICG-MSFD members joining (See Annex II for a list of JMP and ICG-MSFD delegates)

- Actions arising from workshop: for JMP consortium and for ICG-MSFD
- Way forward (next workshop in November 19-20 London)

12.30-13.00 Lunch (sandwiches and fruits provided)

13.00- End

14.00- JMP team to review actions from the workshop

Annex I: Selected case studies and policy questions for discussion.

1. Indicator D5 Eutrophication: 5.2.1 Chlorophyll

Contact person: Hans Ruiter (hans.ruiter@rws.nl)

Indicator:

Concentration of chlorophyll in waters during the growing season

Indicator status:

Already used for WFD and OSPAR Comprehensive procedure assessments and HELCOM. Proposed Common Indicator for D5 by OSPAR

Constraints:

Chlorophyll is currently monitored for various purposes by Member States from a variety of platforms using multiple sampling techniques and analytical methods. Statutory monitoring is undertaken for WFD (coastal zone), OSPAR COMPP (marine waters not screened out) and in the Baltic for HELCOM eutrophication assessments. Measurements are taken by direct water sampling, fluorometry (vessel deployed instruments, moorings, underway monitoring) and remote sensing and samples (for direct measurement or calibration of fluorometers) are analysed using a variety of techniques targeting various photosynthetic pigments. These techniques are summarised briefly below:

Most commonly, uncorrected Chlorophyll a is measured by either spectrometry or fluorometry. These techniques include the influence of phaeophytin on the measurement which can be corrected for using an acidification step in the sample preparation. Phaeophytin can be quantified separately using such a technique. More accurate quantification of chlorophyll a and b can be achieved using HPLC with UV or diode array detection. However, the values returned from such a procedure are lower than derived from fluorometry as other pigments are not contributing to the measured signal response in samples.

Further, assessments of monitoring data are undertaken using a variety of metrics and thresholds depending on the purpose of the monitoring programme and national approach taken to assessment. Preliminary analysis of the national reports submitted under Article 11 of MSFD already suggests that a range of metrics (mean, 90th percentile etc) of data are assessed against regionally varying thresholds.

For the purposes of regional assessment under MSFD, some standardisation is required both of monitoring technique, analysis, assessment methodology and threshold setting, while allowing flexibility for innovative monitoring approaches that could allow cost savings such as remote sensing. Previous attempts to intercalibrate chlorophyll measurements between member states for WFD have been unsuccessful. Therefore, this case study will help to explore a standardised approach to monitoring.

Geographical:

Whole regions: Greater North Sea and Celtic Sea (noting limitations at coastal zone associated with suspended solids for some techniques).

Temporal: "Growing Season" for phytoplankton Time period currently varies by member state but within March to October.

Interesting aspects of this indicator:

- In spite of many years data collection for multiple purposes, differences in approach and lack of standardisation of methods means broad scale assessments are difficult to achieve.
- The need to assess the same indicator measured from multiple techniques and platforms

POLICY QUESTIONS FOR CONSIDERATION

1. Development of indicators

A main issue for standardization is the definition of the metric in relation to the analytical method. This is explained below:

- Chlorophyll-a is used as a measure for the biomass of phytoplankton. The phytoplankton composition may vary widely in time and space
- The most used and oldest analytical method is the spectrophotometer or fluorometer. It is well known from the literature that these methods do not measure chlorophyll-a in a very precise manner, as other pigments interfere with these measurements.
- The presence of these pigments depends on the phytoplankton composition, thereby affecting the accuracy of the determination of algal biomass.
- The alternative analytical method is HPLC (high performance liquid chromatography), which separates all the pigments before they are measured. Interference between pigments is not possible. The values measured are lower.
- Therefore, the most accurate way of measuring chlorophyll is with HPLC.

Work is ongoing to evaluate the analytical methods within the QUASIMEME10 quality scheme. The conclusions of their last workshop (February 2014) are:

- Comparison between laboratories show that 20% or more of the results are questionable or unsatisfactory.
- The performance with proficiency (interlaboratory) testing over the years is getting worse
- HPLC results are more consistent than the other methods
- Chlorophyll-a concentrations are lower when determined with HPLC
- More standardization is needed.

Questions/statements

The main question is: what hampers adoption of HPLC as the common method and further standardization of the metric? Considerations are:

- The added value of HPLC may not be convincing (e.g. depends on the composition of the phytoplankton);
- HPLC equipment is more expensive than spectrometry or fluorometry. However, what are the

¹⁰ The acronym QUASIMEME comes from its EU project name "Quality Assurance of Information for Marine Environmental Monitoring in Europe" which was founded in 1992. At the heart of the programme is a holistic learning-by-doing spiral. The routine laboratory performance studies provide the basis of external quality assurance for institutes that make regular chemical measurements in the marine environment.

costs of doubtful results?

- Continuation of time series using spectrometry or fluorometry may be preferred;
- (political) uncertainties around the consequences of changing the outcome of the assessment;
- The HPLC method enables many samples processed by automation in a short time. Is there a risk of losing jobs?

2 International co-ordination

The MSFD requires coherence of assessments within (sub) regions. At the same time, national agreements and policies to combat eutrophication cannot easily be changed without socio-economic consequences.

Another important issue is the cost of monitoring. There is a tendency to decrease the number of sampling locations and the geographical area covered. This may lead to less robust assessment outcomes.

Questions/statements

- How could joint monitoring contribute to solving the issue of costs and geographical coverage?
- Do the requirements for joint monitoring (more standardization) conflict with the current practice of national assessments? How can this be solved?

3. Multi-use of platforms

The use of innovative techniques (e.g. ferry box, remote sensing and modelling), in addition to targeted monitoring surveys enables reduction of sampling effort in the latter category, whilst maintaining or even improving the results of the assessment. Requirements are:

- Data from innovative techniques need to be transferable to quantitative measures of chlorophyll-a.
- For calibration purposes high-quality Chlorophyll-a measures are needed. Models also require reliable measures.
- The assessment of eutrophication includes the results of these novel methods.

Questions/statements

- How urgent is the inclusion of novel techniques in eutrophication monitoring?
- Can the development of scenarios for multi-use of platforms and integrated monitoring (e.g. in the JMP NS/CS project) contribute to the decision making process? What information is needed?
- How does the use of innovative techniques and standardization of chlorophyll-a relate to national monitoring programmes? And to joint monitoring?

4. Data availability, reporting and assessment

Statement

A coherent assessment of chlorophyll-a asks for a joint programme based on cost efficient standardized measurements and a robust coverage based on a smart combination of in situ sampling and the use of innovative techniques.

Questions:

- How should a transition period towards a joint programme look like?
- Need for conversion factors?
- A joint monitoring programme running in parallel with current programmes for some time to enable comparison of old and new time series? And testing of new assessment outcomes?
- Exchange of staff for training purposes?
- Further suggestions?

2. Indicator 2: Indicator D1 fish

Contact: Ingeborg de Boois (Ingeborg.deboois@wur.nl)

Indicator:

For a suite of selected species: demersal elasmobranch species in the North Sea and Celtic Sea (Dransfeld 2013):

- Distribution of the species: % occurrence (number of hauls in which a species was found/total number of hauls carried out, by year)
- Population abundance: CPUE by year
- Differences in abundance

Indicator status:

No official status, based on Dransfeld (2013)

Constraints:

- Data deficiency due to low abundance, suboptimal fishing gears, low sampling frequency. Only possible to use trend analysis, no targets due to data deficiency.

Geographical:

- The greater North Sea (including English Channel) and Celtic Sea. Information from all areas is relevant, especially because the natural distribution patterns vary per species.

Temporal:

The whole year round.

Interesting aspects of this indicator:

- No specific monitoring method has been defined yet. There is an opportunity to look for options of combining survey data from various international and national surveys (this aspects will be assessed during Activity E); opportunity to consider various sampling methods and platforms (part of Activity C)
- Applicability of the obtained data to several indicators
- Reference to the IUCN list of threatened and declining species, although there is no OSPAR Common Indicator or MSFD indicator has been fully defined yet. The intention of including monitoring of elasmobranch fishes into the description of GES can be expected.

References:

Dransfeld, L. 2013. Elasmobranch assessment for the Irish MSFD. Working document for WGEF 2013.

POLICY QUESTIONS FOR CONSIDERATION

1. Development of common indicators and targets

Elasmobranch species (a selected number of species in the BHD list) would be a good metric for the OSPAR common indicator D1 Fish 1, but there needs to be enough data to assess against targets and baselines. The issue raised in the case study description of the inability to set fixed targets for these species - due to data scarcity - may not be a problem. Many biodiversity indicators are - or will be - assessed against a trend type of target (trends are also considered as targets under MSFD);

- Elasmobranch species for MSFD could be well accepted since they have protection plans under the BHD and have to do something anyhow. The issue then is that BHD targets differ between MS, which doesn't help at all their protection. So harmonisation of targets is a policy issue here AND also the accumulation of policies (policy makers would like to avoid an accumulation of regulations). The harmonisation issue is an issue outside the scope of our project.
- An important question to policy colleagues is: would you choose elasmobranch species under D1 Fish 1 if we can improve the data availability?

2. International co-operation

- Would policy makers would consider pulling together all current monitoring data (different surveys, within the domain of IBTS and BTS or also including other surveys, eg for scientific purposes) or maybe try to organise more monitoring or better monitoring (adapted gear, improved geographical coverage) for elasmobranchs?

3. Multi-use of platforms:

- Act C workshop proposes to use other techniques: tagging and genomics, to improve understanding of distribution of elasmobranchs that can inform geographic coverage of monitoring.
- What shall we consider this advice (e.g using other techniques)? Is this a policy issue? A useful approach could be to try to have the budget to further develop the methods or trial additional techniques, which will need support from policy makers. Hence is it useful to inform them on these methods? And potential suggestion to improve the current work?

4. data availability/reporting:

- What are the main issues to data sharing?
- BTS/IBTS: current commercial fish monitoring is well co-ordinated internationally and the data are accessible to all. What about elasmobranch data? Are these reported and accessible at the North Sea/Celtic Sea level? Any support needed from policy makers?
- landings data: from the case study description that landings data are being used to assess elasmobranchs rather than IBTS/BTS survey data, there will be a need to standardise this information.

3. Indicator D1/D6 benthic habitat condition

Contact person: Gert Van Hoey (gert.vanhoey@ilvo.vlaanderen.be)

This case study is proposed by benthos experts from within JMP NSCS and/or the ICES Benthos Ecology Working Group (BEWG), the latter having a long-standing interest and expertise in benthic indicators for ecosystem health and benthic monitoring activities.

Indicator:

Benthic habitat condition can be assessed by benthic indicators (univariate, multi-metric, multi-variate¹¹), which mostly rely on species-abundance data. A wide variety of benthic indicators exists for marine systems (for a most recent overview see: <http://www.devotes-project.eu/devotool/>).

Due to this diversity in benthic indicators, we propose for this case study:

- Not to use the multi-metric indicators themselves, but the underlying variables and parameters (i.e. species abundance, species richness, Bray-Curtis similarity (measures of species composition (turnover) / community hetero-/homogeneity), biomass, species sensitivity [AMBI, sum (E5500.05)]). This will allow us to draw conclusions that are applicable to a wide set of multi-metric indicators.
- To run the analyses at the level of selected multi-metric benthic indicators. Indicators defined under WFD, MSFD, Habitat directive, OSPAR or HELCOM can be selected for this purpose.

Indicator status:

Benthic habitat condition is an important aspect taken into account by all EU Member States (MSs) under the different nature directives, including MSFD. A few EC MSs (i.e. UK, Belgium and Denmark) already mentioned multi-metric benthic indicators in their MSFD Articles 9 and 10 reports to the EC. Others are expected to implement the use of such indicators within their MSFD 1st cycle assessments. The (draft) OSPAR ICG-COBAM common approach for benthic habitat assessment identifies that benthic multi-metric indicators (wide variety available) are essential for determining habitat condition. This common approach does not define a common benthic indicator for all OSPAR regions.

Constraints:

The following (non-exhaustive list of) aspects determine the monitoring and related quality assessment of benthic habitats:

- Level of detail in habitat definition: a broader definition of a benthic habitat type (e.g. EUNIS A5: sublittoral sediment) can lead to a higher variability in its characteristics than a narrow definition (e.g. EUNIS A5.2 sublittoral sand).
- Areal extent of the habitat type: the difference in spatial distribution of a habitat (widely distributed versus local) may have an influence on the monitoring design needed.
- Habitat heterogeneity/homogeneity: community composition heterogeneity may differ between different habitat types. Therefore, heterogeneous habitat types will have other monitoring requirements than homogeneous habitat types (less variable characteristics).
- Sampling techniques: benthic habitats can be surveyed by different grab, core or even dredge sampling techniques and benthic samples may be handled differently (e.g. sieve mesh size, sieving alive or after fixation).

¹¹ Both multi-metric and multi-variate indicators are further referred to as multi-metric indicators.

- Period of sampling (more than once a year, yearly, every 2-3 years): the benthos shows a clear seasonal and year-to-year variability, which will influence the monitoring design.
- Variables /indicator demands: different variables will show different value ranges, sensitivity to outlier values (maxima) and levels of variability, which has its effect for example on the sample intensity requirements. For example, you need more samples to scope the variability in biomass (values highly variable among species) than number of species to reach a certain statistical power.

Geographical:

Both the greater North Sea (and Celtic Sea) may be targeted in this case study: the final selection will be based on data availability and suitability. The applicability of the results to other geographical areas will be assessed.

Interesting aspects of this indicator:

The case study will contribute to the development of an efficient regional approach to monitoring benthic condition assessment. It will as such inform on:

- the possibilities to integrate (nationally proposed or efficient monitoring program) sampling effort (minimally) needed into interdisciplinary monitoring campaigns
- the potential of complementing monitoring designs (cross-boundary) throughout the greater North Sea (and Celtic Sea)
- the applicability of a wide set of analytical tools in developing efficient monitoring programmes

POLICY QUESTIONS FOR CONSIDERATION

An optimal (spatial) sampling design to assess GES at sub-regional (North Sea) level will most likely lead to an unequal distribution and number of samples of the different MS' marine waters.

- This may lead to a reduction or increase of the number of samples and the coverage at the level of an individual MS. MS will however be expected to adapt their programme to the new (spatial) sampling design.
 1. Will MSs accept such interference with their ongoing monitoring programme?
 2. Is the EC prepared to accept an optimal estimate of ES for the North Sea, while not being able to differentiate between the ES in individual MS waters?
- An unequal distribution of samples will lead to an optimal sampling design for the North Sea, but may equally lead to an "under-/overrepresentation" of individual MS waters. If the North Sea would be found not to be in GES, then measures are to be taken. Measures are decided upon at the level of individual MS.
 3. How to decide who is to take mediating measures, if a differentiation in ES is impossible at the level of individual MS? Can this be done?
- An optimal (spatial) sampling design will unavoidably necessitate a choice of acceptable levels of reliability (cf. statistical power to detect deviations from GES) and/or a maximum number of samples (cf. financial restrictions)
 - ii. Who is going to decide on what the acceptable levels of reliability actually?

- iii. Is there need for an agreement of acceptable reliability levels at a sub-regional scale?

4. Indicator D10 Marine litter: Seafloor Litter

Contact person: Thomas Maes (thomas.maes@Cefas.co.uk)

Large-scale seafloor surveys off the European coast have found widespread presence of bottles, plastic bags, fishing nets, and other types of plastics. Plastics are the most abundant litter found in the marine environment and comprise more than half of marine litter in European Regional Seas.

OSPAR Contracting Parties have made agreements on Common and Candidate Indicators to be used by as many Contracting Parties (and EU MS in their MSFD Monitoring plans) as possible without obligations. In relation to marine litter the following indicators have been proposed:

- **Common Indicators:**
 - Beach litter (all CP's)
 - Plastic Particles in Stomachs Fulmars (North Sea) as floating litter indicator (and impact on biota)
 - Seabed litter using International Bottom Trawl Surveys (IBTS)
- Candidate: other target species/impact on biota indicators (outside North Sea) - in development
- Candidate: microplastics (currently not defined, R&D will continue to close knowledge gaps)

This study will examine the following procedures:

- Seafloor marine litter sampling
- Sampling protocols and analysis
- Data analysis and aggregation; e.g. rules for combining data from different fisheries surveys
- Thresholds and assessments; e.g. reporting for national purposes, OSPAR, EU

Monitoring of marine litter is carried out in the N-E Atlantic by Contracting Parties in accordance with the recommendations from the OSPAR Inter-correspondence Group on Marine Litter and the guidelines of the EU MSFD Technical Subgroup 10. OSPAR provides specific guidelines for monitoring beach litter and plastic in fulmars, used in litter assessments (QSR, EcoQO). Guidelines for monitoring of benthic marine litter can be found in the advice from TSG10 and as an annex in the ICES IBTS manual.

Indicator status:

Seafloor litter is an indicator specified in the MSFD Commission Decision and is an OSPAR Common Indicator.

Constraints:

No dedicated surveys or monitoring program. The Seafloor litter indicator is included in the IBTS manual, but participation is still voluntary and done differently on the vessels. Furthermore the geographic distribution of the IBTS might be too limited to pick up trends in the amount of seafloor litter. There might

be good opportunities to extend the IBTS data with other sources of data.

Geographical:

This study will focus firstly on the southern North Sea, but can easily be expanded to the Celtic Sea if other fisheries surveys than the International Bottom Trawl Survey (IBTS) are included.

Temporal:

The monitoring and assessment period is from 2012 onwards as data from most CPs will start then.

Interesting aspects of this indicator:

There are agreed protocols for monitoring seafloor litter (TSG10) and most partners of this consortium carry out fish stock surveys. There is an increased focus on marine litter from EU, OSPAR and the general public. It is widely recognised that it is a “new” science and gaps are still present. Marine litter data and assessments need to be harmonised and improved for MSFD purposes and between OSPAR Contracting Parties. However a first study of Cefas has indicated that the power to detect trends which might be an effect of implemented measures are rather low. To improve these trends a higher number of monitored stations is required. Therefore there is a need for a harmonised monitoring approach across different MS/CPs. If the monitoring burden of all these stations could be split across MS/CPs and assessed as a whole we can determine trends with increased power (“united we stand strong” > similar to contaminant monitoring and assessments). This study will look at whether the apparent surveys are significant different and will potentially propose ways of more closely aligning procedures in the future.

POLICY QUESTIONS FOR CONSIDERATION

1. Development of common indicators and targets

- Considering the transboundary nature of the marine litter issue and the transboundary nature of its sources (maritime industry, waste water, etc), have you considered addressing marine litter through an international cooperation with common targets and indicators?
- Have you given specific consideration to the question of the trends (e.g. decrease in litter) a seafloor litter monitoring program must be able to detect, and with which power and precision?
- Are you proposing indicators that would require monitoring of microplastics and/or plastic in biota? If yes, how do you intend to do so?

2. International co-ordination

- Have you compared strategies with other countries prior to designing monitoring plans for your EEZ? Why? Why not?
- Is your country going to follow the OSPAR monitoring guidelines on litter or do you plan to follow a different pathway, i.e. developing your own programmes?
- If following OSPAR, are you following the protocols for all litter categories?
 - Floating litter= fulmar stomachs
 - Sea floor litter = IBTS sampling

- Beach litter = OSPAR beach monitoring

Considering the transboundary nature of the marine litter issue and its sources, would you be willing to share funding and data for a wider marine litter programme?

- If not, are you aware that the IBTS would allow other MS to collect data in your EEZ?
- Would you be willing to fund other MS institutes to collect this litter data in your EEZ?

3. Multi-use of monitoring platforms

There is general consensus that bottom trawl surveys can be used to monitor seafloor litter.

- Have you considered options that include novel uses of other existing platforms to monitor litter in your EEZ?
- Have you encountered obstacles in your country relating to the use of fisheries surveys in the monitoring of non-fisheries related environmental parameters?

By relying on the IBTS (or other fish/observer survey), litter monitoring will inherently depend on DCF funding and priorities set by the DCF. Have you given this any consideration and are there opportunities available to appropriately address this issue?

4. Data availability, reporting and assessment

Are you willing to report marine litter data from your EEZ to an international database (e.g. ICES)? Which conditions would apply?

- Have you considered what cost would be realistic for collecting data on seafloor litter (by nation, by year or MSFD cycle; a) 0-5.000 euro, b) 5.000-10.000 euro, c) 10.000 euro – 50.000 euro, d) more)?

Additional policy questions for discussion during World Cafe session from dedicated Activities

Activity C (MULTIDISCIPLINARY: To assess the opportunities for multi-disciplinary monitoring programmes) and E (TOOLS: to adopt and/or develop integrated monitoring tools (e.g. GIS-tool, statistics-tool)).

Development of common indicators and targets

- Some countries prefer or refuse to use specific methods.
- Do they have the power to decide about indicators to be used, or accuracy of data needed for their political decisions?

International Co-ordination

- Not all sampling techniques are allowed in all national waters
- International cross-border coordination is nearly mandatory for designing cost-efficient multi-disciplinary North Sea wide monitoring, fisheries monitoring provides a good example.
- Currently: crossing national borders leads to inefficient and costly permit procedures.
- Is there a need for common currency on certain indicators (e.g. clustering information or looking at information with similar outcomes)?
- Large number of stations to detect spatial changes, individual countries could work more together to get wider benefits of coping with data collection and analysis?

Multi-use of monitoring platforms

- Altering existing monitoring affects time-series. Only possible when comparative sampling takes place.
- There is downtime available on various existing field activities. But using this time is not for free
- Weather always requires flexibility in marine monitoring, however the required flexibility increases when monitoring is multi-disciplinary.
- Multi-use requires setting priorities.
- The IBTS is a good model, but this only pertinent for fish. We could do something similar for litter, contaminants and chlorophyll, etc. but it will be very expensive, could be do some sampling and complement with other techniques (e.g. passive samplers, smart buoys, etc.)

Data availability, reporting and assessment

- Explore data from existing monitoring before deciding if more data is needed.
- Collection of samples in the field is not all, data needs to be shared, samples need to be shipped, and samples need to be processed

Annex II: Participants

Confirmed participants at the Joint Monitoring Programme (10 and 11th September)

Name	Country	Affiliation	10/ 9	11/ 9	Role
Silvana Birchenough	UK	Cefas			Activity D project Leader
Lisette Enserink	The Netherlands	Rijkswaterstaat			JMP Project Leader
Ralf van Hal	The Netherlands	IMARES			Activity C Leader
Francisco Marco-Rius	Germany	Federal Research Institute for Rural Areas, Forestry and			Activity E Leader /Fis CS

		Fisheries			
Bill Turrell	Scotland	MSS			Activity I Leader
Stephen Malcolm	UK	Cefas/Defra			JMP policy liaison group
Jo Foden	UK	Cefas/Defra			JMP participant and MSFD Lead
David Righton	UK	Cefas			TIME project
Hans Rooter	The Netherlands	Rijkswaterstaat			JMP participant/ Chlorophyll CS
Jolande de Jonge	The Netherlands	Rijkswaterstaat			JMP participant
Isabelle Terrier	France	Ministère de l'Ecologie, du Développement Durable et de l'Energie			MSFD Lead
Jean-Paul Lecomte	France	IFREMER			MSFD Lead
Thomas Kirk Sørensen	Denmark	DTU Aqua consultancy			JMP partner/ litter CS
Dónal Cronin	Ireland	Department of Environment, Community and Local Government			MSFD Lead
Dominic Pattinson	UK	Department of Environment, Food and Rural Affairs (Defra)			MSFD Lead
Gert Verreet		OSPAR Secretariat			OSPAR ICG-MSFD
Wim van Urk	The Netherlands	Ministry of Infrastructure and the Environment			MSFD Lead/Chair of ICG-MSFD
David Mallon	Scotland	Marine Planning & Policy, Marine Scotland			MSFD Policy
Gert Van Hoey	Belgium	ILVO			JMP partner/benthic CS

Karl Norling	Sweden	Swedish Agency for Marine and Water Management			Policy and Monitoring
Deborah Hembury	UK	Defra			MSFD Policy
Steven Degraer	Belgium	RBINS			JMP Activity A-B Leader
Richard Moxon	UK	DEFRA			Policy

ICG-MSFD participants at the Joint Monitoring Programme North Sea / Celtic Sea Project Workshop and Lunch.

Attendees	Delegation
David Connor	European Union
Emilie Pleyber	France
Ingo Narberhaus	Germany
Annika Grage	Germany
Eirik Drabløs Pettersen	Norway
Laura Piriz	Sweden
Darius Campbell	OSPAR Secretariat
Gert Verreet	OSPAR Secretariat

Workshop 2: Agenda

Towards a Joint Monitoring Programme for the North Sea / Celtic Sea (JMP NS/CS)

2nd Activity D Workshop

Dates: Wednesday 19th November 2014

Venue: Dover House, Whitehall London SW1A 2AU

- 0900 1) Welcome and Domestic Arrangements [Silvana Birchenough, Cefas; Bill Turrell MSS]
- Definition of JMP (Bill Turrell, MSS)
 - Introduction to Activity D (aims and progress) and messages from Activity, C and E
 - Introduction of the Day [Silvana Birchenough, Cefas]
- 1000 2) Coffee
- 1030 3) Discussion sessions (Session 1, 2 and 3) discussion of ~ 30-40 minutes/plenary feedback.
- 1200 4) Feedback in plenary and discussions
- 12.30 5) Lunch
- 13.20 6) Session 4: Ways of working in the future
- 15.00 7) Coffee Break
- 15.30 8) Final wrap up session
- 16.30 9) End of the meeting

Initial questions for internal discussions:

- What are the main issues associated with monitoring in your organisation, country, etc?
- What are the main Institutional barriers or any other issues which could hamper co-ordination (any other problems)?
- Can you comment on issues associated with Data sharing and co-operation (e.g. nationally, internationally)?
- Can you identify ways of improving the current monitoring work/relationships (e.g. nationally and internationally)?
- Could you provide information on specific lessons learned from your current monitoring experience and suggest a way forward for International collaboration?

Surname	First Name	Institute
Birchenough	Silvana	Centre for Environment, Fisheries and Aquaculture Science
de Jonge	Jolande	Rijkswaterstaat (only attending the afternoon)
Cronin	Dónal	Department of Environment, Community and Local Government
Degraer	Steven	Royal Belgian Institute of Natural Sciences
Enserink	Lisette	Rijkswaterstaat
Foden	Jo	OSPAR
Fossing	Henrik	Aarhus University
Gubbins	Matthew	Marine Scotland Science
Hansen	Jen Würgler	Aarhus University
Hansson	Maria	Swedish University of Agricultural Sciences
Johnston	Charlotte	Joint Nature Conservation Committee
Lecomte	Jean Paul	French Research Institute for Exploitation of the Sea
Maes	Thomas	Centre for Environment, Fisheries and Aquaculture Science
Moffat	Colin	Marine Scotland Science
Nixon	Eugene	Marine Institute
Rius	Francisco Marco	Thünen-Institute of Sea Fisheries
Rotteveel	Serge	Rijkswaterstaat
Sorensen	Thomas Kirk	DTU Aqua
Turrell	William	Marine Scotland Science
Vanden Berghe	Marie	Royal Belgian Institute of Natural Sciences
Vossebelt	Gerrit	Rijkswaterstaat
Wennhage	Håkan	Swedish University of Agricultural Sciences