



Optimising French fisheries surveys for marine strategy framework directive integrated ecosystem monitoring

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ABSTRACT

The French initial assessment of the Marine Strategy Framework Directive (MSFD) highlighted the lack of reliable data concerning offshore areas. During the planning of the monitoring programmes, the scientists therefore proposed to partially cover this gap by using existing fisheries research vessel surveys deployed for the purposes of the Common Fisheries Policy (CFP). This paper describes ways of improving the effectiveness of these surveys and making them better suited to delivering the information needed for the MSFD. The process took two years and became operational at the beginning of the year 2016. Testing phases from October 2013 to August 2015 had to be organized to fit within the ongoing fisheries tasks without significantly increasing the workload in terms of both time and human resources. Six fisheries research surveys henceforth collect new data, with or without additional sampling techniques. Specific examples are given with litter and hydrological data which will be used to assess the environmental status of French marine waters. The paper also identifies certain limitations regarding this approach. This French experiment enabled more efficient and effective use of current data collection efforts, while optimising vessel time and implementing an ecosystem approach in collecting data for fisheries management.

1. Introduction

The EU Marine Strategy Framework Directive (MSFD, 2008/56/EC) establishes a framework within which EU Member States shall take action to achieve or maintain good environmental status (GES) of their marine waters by 2020 [1]. GES is based on 11 qualitative descriptors, as listed in Annex I of the MSFD. The first stage of this marine strategy was for all Member States to carry out an initial assessment of the current status of their seas. The 2012 French initial assessment highlighted that there was a significant lack of data concerning offshore areas (beyond the 20 m isobath) in comparison with coastal and transitional waters monitored for the Water Framework Directive (WFD; [2]) [3–6]. Crise *et al.* [7] came to the same conclusions for southern European seas under the Perseus experiment, where data availability was poor in open sea for most of the descriptors. Teixeira *et al.* [8] noted that the number of indicators decreased noticeably from shallow to deep waters, due among other factors to the lack of sampling. The general conclusions of technical assessment reports highlighted for all

French marine sub-regions the lack of standardized and accessible observational data for offshore areas [9]. These knowledge gaps remain an issue for the computation of operational indicators to assess correctly the state of the marine environment that have emerged from recent legislative commitments [10]. In order to collect information on anthropogenic disturbances and their impact on the environment and to develop a proper scientific and technical basis for the implementation of actions aimed at improving the quality of the marine environment, it is necessary to conduct regular surveys, collect data and analyse their results.

Creating new surveys entirely dedicated to MSFD would be very time consuming and costly, probably resulting in insufficient spatial or temporal coverage. A better strategy would be to adapt and optimize existing surveys. Monitoring programmes (MP) could be efficiently developed by using survey downtimes for additional sampling. In particular, fisheries surveys could play an important role in MSFD monitoring programmes [11,12], as they are the only surveys that sample the EU offshore and coastal marine waters each year. The French

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Research Institute for the Exploitation of the Sea (Ifremer) has been carrying out standardised fisheries surveys every year for the last three decades in the seas surrounding France. These surveys use either bottom trawls or a combination of fisheries acoustics and pelagic trawl sampling. Additional sampling techniques (e.g. floating-manta trawl, WP2 plankton net, etc.) are used in some cases. The various different - but compatible - existing monitoring methods need to be adapted and standardized to take into account regional differences. When planning monitoring schemes, care should be given to ensure suitable spatial and temporal scales. Sampling protocols in Europe are currently available for the assessment of certain indicators (see e.g. ICES Survey Protocols, <http://www.ices.dk/publications/our-publications/Pages/Survey-Protocols.aspx> - Accessed 05 January 2018), but should be adapted to MSFD requirements and standardized for compatibility with other regions.

This is the aim of the Joint Monitoring Programmes (JMP), that examine how much and what type of sampling is needed, at a minimum, in order to achieve quality standards and how these data could be collected most efficiently [11,13]. Pioneering integrated surveys [12] and pilot projects (e.g. De Boois and van Hal [14]) have demonstrated that indicators of other ecosystem component states could be measured alongside routine biological sampling conducted for fish stock assessments during fisheries surveys in the Regional Sea Conventions (RCS) areas (e.g. International Bottom Trawl Surveys (IBTS) under the Barcelona Convention for the Mediterranean; the Bucharest Convention for the Black Sea; the Oslo-Paris Convention (OSPAR) for the NE Atlantic, and the Helsinki Convention (HELCOM) for the Baltic). However, sampling activities cannot be extended endlessly without compromising data quality [11]. Ecosystem sampling should indeed be optimised in a coordinated and adaptive way, to ensure that the addition of new sampling protocols does not compromise the quality of standard data collection, and to optimize the utility of the sampling programme. If interesting studies have provided general principles [11,15], few practical examples of the optimisation of data collection programmes for ecosystem sampling are to be found in the literature (but see e.g. [12]).

The aim of this paper is to bridge this gap by presenting a practical example of the optimisation of a data collection programme to meet MSFD ecosystem monitoring requirements. The article describes how French fisheries surveys were optimised to move on from single-species stock assessment toward MSFD compliant ecosystem monitoring.

2. Material and Methods

2.1. French monitoring programmes

The second stage of the marine strategy was to establish and implement monitoring programmes to measure progress towards GES. The very wide scope covered by MSFD requires additional monitoring in areas where it was not previously required by EU law [13]. In France, the definition of the MP lasted from 2012 to 2015 under the supervision of the Ministry of Environment, and coordinated by the Marine Protected Areas Agency (AAMP) and Ifremer. Scientists designated for each of the 11 descriptors undertook the design of these MP (a complete survey programme for each descriptor, including terrestrial, aerial and nautical means). In 2012, each of them suggested that vessel-based surveys should collect data for MSFD. On this occasion, they identified existing observation platforms provided by research vessels (R/V) which were mainly involved in fisheries stock assessment, as a potential way of providing additional means of monitoring. The MSFD coordination team from Ifremer therefore proposed to explore the possibilities of adding MSFD monitoring to existing vessel surveys.

A similar choice was also made by most Member States, which decided for cost-efficiency reasons to develop their MP by extending existing monitoring activities [11]. Moreover, previous management strategies focusing on specific human impacts or individual species

have been judged insufficient for the implementation of the ecosystem approach called for by new regulations such as MSFD [15]. In France, the PELGAS survey [16] followed an ecosystemic approach by monitoring hydrology, phytoplankton, zooplankton as well as birds and mammals, in addition to its fish stock assessment role, from 2000 in the Bay of Biscay. This survey demonstrated the potential of fisheries surveys for ecosystem monitoring [12,17].

2.2. Feasibility study for optimisation of the French fisheries surveys

Following the proposals made in 2012, the optimisation of vessel surveys in France was considered a priority because it offered the means to obtain suitable offshore data at moderate cost. It was pointed out that the MP should be able to provide data for the calculation of the indicators set by the Commission Decision (e.g. [13]). The data to be collected were consequently related to the requirements of the MSFD, and particularly information on indicators of several quantitative descriptors selected by the European Commission [18]. French research scientists selected the following criteria for good environmental status relevant to the descriptors of MSFD: (i) biodiversity: distributional range, pattern and area covered by the species; population abundance, demography and genetic structure; condition of typical species and composition of species; (ii) habitat: physical, hydrological and chemical conditions; (iii) productivity: performance of key predator species using their production per unit biomass; (iv) eutrophication: nutrients, dissolved oxygen, water transparency, chlorophyll concentrations and phytoplankton community composition; (v) contaminants: concentration of contaminants measured in biota; (vi) marine litter: amount of floating litter (including micro-particles) and litter deposited on the seafloor; and (vii) energy: distribution of underwater noise. They are used for the requirements of descriptors 1 Diversity (i/ii), 4 Food webs (iii), 5 Eutrophication (iv), 8 Contaminants (v), 9 Contaminants in fish and seafood (v), 10 Litter (vi), 11 Energy and noise (vii). These descriptors were selected because they could be collected during fisheries surveys to compensate for the lack of French data in offshore areas [3–6].

A feasibility study was launched in October 2013 to assess the compatibility between the proposals made by the scientists, linked to the previous data, and the fisheries stock assessment operations. This preliminary stage was developed with the help of vessel-based survey coordinators. The MSFD coordination team from Ifremer sent a questionnaire concerning new protocols to implement for the requirements of the directive. The main topics in the questionnaire were: additional monitoring and parameters to be recorded, vessel survey concerned, sampling strategy, operational protocol onboard and logistic. This was applicable to all vessel surveys (coastal and off-shore) implemented by Ifremer for fisheries stock assessments. The aim was to make a first selection among the various proposals taking into account the logistical limits to the amount of work that can be done in a single survey, and the priority given to the primary survey objectives defined by the funding provider [11]. The preliminary indications from the questionnaire lead the MSFD coordination team to exclude the vessels and surveys that were not appropriate to conduct the proposed monitoring operations (e.g. irrelevant survey areas, vessel too small...). In February 2014, an analysis of the results of this questionnaire was conducted. Six vessel surveys were chosen on the basis of four major criteria: the possibility of having more people onboard, of working on a continuous basis (day / night), of loading and deploying more sampling equipment, and the areas covered by the French surveys. These fisheries surveys are conducted with two R/V, *Thalassa* in the Atlantic region and *L'Europe* in the Mediterranean sea (see Table 1 for a presentation of their main characteristics).

As a result, the second step involved the deployment of near-operational field tests between September 2014 and August 2015 [19]. In addition to already known operations (e.g. seafloor litter, water nutrients, mammals and birds, etc.), two new protocols for routinely monitoring fisheries surveys were tested. The first was devoted to the

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