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STRENGTHENED FOLLOW-UP AND EVALUATION OF THE SWEDISH PROGRAMME OF MEASURES FOR THE MARINE ENVIRONMENT

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The Swedish Institute for the Marine Environment is a national academic node for interdisciplinary analysis and synthesis assisting marine environmental governance, founded on a collaboration between the University of Gothenburg, Stockholm University, Umeå University, Linnaeus University, the Swedish University of Agricultural Sciences and Chalmers University of Technology.

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PREFACE

This report was prepared by the Swedish Institute for the Marine Environment with funding from the Swedish Agency for Marine and Water Management (SwAM). The purpose of the report is to contribute to strengthened follow-up and evaluation of the measures established in the Swedish Programme of Measures (PoM) for the marine environment.[1] The project group consisted of researchers with broad interdisciplinary expertise from the University of Gothenburg, Luleå University of Technology, the Swedish University of Agricultural Sciences, Södertörn University, and the Swedish Institute for the Marine Environment.

Numerous management measures are being taken in Sweden to address marine environmental problems. As part of adaptive management, it is essential to evaluate the effects of these measures so that they can be optimised and adjusted if necessary. The report presents an evaluation model that is recommended for evaluating the effects of measures in the PoM. The potential use of the model is illustrated by applying it to several existing measures. Possible methods for evaluating the measures are suggested based on the expertise of the members of the project group. However, the choice of specific methods and appropriate data are issues to be decided in future evaluations and on a case-by-case basis. The proposals and recommendations of the project should thus be seen as a first step, in which the implementation of the proposed evaluation model can contribute to more coherent and structured evaluations of measures in the PoM.

The report was written by Ulla Li Zweifel, Johanna Gipperth, Lena Bergström, Anders Ivarsson Westerberg, Jesper Stage, Eva-Lotta Sundblad, Håkan Wennhage and Aron Westholm. The authors are responsible for the content and conclusions of the report.

The authors would like to thank the administrators at SwAM who commented on the project plan and the report, as well as the three anonymous reviewers whose constructive comments contributed to improving the report.

This report was originally published in Swedish. The Swedish version also contains recommendations on how SwAM could organise the collection of data and information related to the measures in the Swedish PoM.

[1] In Swedish, the programme is called “Åtgärdsprogram för havsmiljön”, abbreviated “ÅPH”.

CONTENTS

SUMMARY

In Sweden, measures to improve the marine environment are based on a mosaic of different programmes of measures and legislation. The aim of the EU Marine Strategy Framework Directive, and the corresponding Swedish Marine Environment Ordinance, is to achieve a good environmental status in the marine environment. The Swedish Programme of Measures established to meet this objective primarily includes measures in the coastal and marine area. Concurrently, several other efforts are being made to reduce the negative impacts on the marine environment, including measures aimed at land-based activities. With multiple efforts running in parallel, it becomes challenging to attribute any changes in environmental status to individual measures or programmes. However, evaluating individual measures and programmes of measures is a prerequisite for optimising the impact of measures, from an environmental and cost perspective.

This report presents the results and recommendations from a project aimed at strengthening the follow-up and evaluation of the Swedish Programme of Measures for the marine environment (PoM) established under the EU Marine Strategy Framework Directive. The project was carried out by the Swedish Institute for the Marine Environment with funding from the Swedish Agency for Marine and Water Management (SwAM).

The recommendations are based on a review of fact sheets and first versions of implementation plans for the measures in the Swedish PoM 2022–2027. Several concepts used by SwAM have also been developed and defined in greater detail. Based on analyses made by the project group, it is recommended that SwAM:

Apply an evaluation model that considers individual measures and that starts with the activities carried out within the administration to initiate the measure. It is proposed that the evaluation of measures follows an effect chain that considers the expected output of the administration's activities, administrative effects, behavioural changes amongst actors outside the administration, and environmental effects. To apply the model, additional aspects also need consideration. In particular assumptions made when developing the effect chain and any potential side effects need to be identified and formulated when the measure is decided upon. The proposed framework for follow-up and evaluation provides for a systematic and coherent evaluation of measures, which is expected to lead to a more cost-effective implementation of measures overall.

Evaluate early steps in the effect chain to identify potential deviations from expected changes or undesirable side effects as early as possible. Regarding environmental effects, it is often difficult to assess the effects of individual measures in the PoM. National and regional environmental monitoring provides data for assessing the state of the marine environment, but in most cases, dedicated monitoring programmes are required to assess the environmental effects of individual measures. In addition, in many cases it takes a long time before measures result in detectable changes in the

environment. Therefore, it is often appropriate to evaluate earlier steps in the effect chain to identify possible needs to adjust the measure. The most appropriate method of evaluation depends in turn on the type of measure and the step in the effect chain that is to be evaluated. Both qualitative and quantitative methods may be appropriate, as well as a mix of methods.

Consider how the measures will be evaluated when they are initially decided upon, to identify the data and types of methods that may be appropriate for future evaluations. The evaluation of measures often requires the collection of new data and information to meet the specific purpose of the evaluation. For some types of evaluations, it is also necessary to collect relevant data and information before measures are implemented. Thus, it is important to consider how measures will be evaluated already in the decision-making stage.

1. INTRODUCTION

1.1. THE SWEDISH PROGRAMME OF MEASURES FOR THE MARINE ENVIRONMENT

The Swedish Programme of Measures (PoM) for the marine environment is a national programme to achieve good environmental status in the North Sea and the Baltic Sea. It is developed and decided by the Swedish Agency for Marine and Water Management (SwAM) in accordance with the Marine Environment Ordinance (SFS 2010:1341), which constitutes the Swedish implementation of the EU Marine Strategy Framework Directive (MSFD)(2008/56/EC). The PoM is updated every six years as part of the implementation of the MSFD (Figure 1). The first PoM for the marine environment covered 2016–2021 and the second updated programme covers 2022–2027.

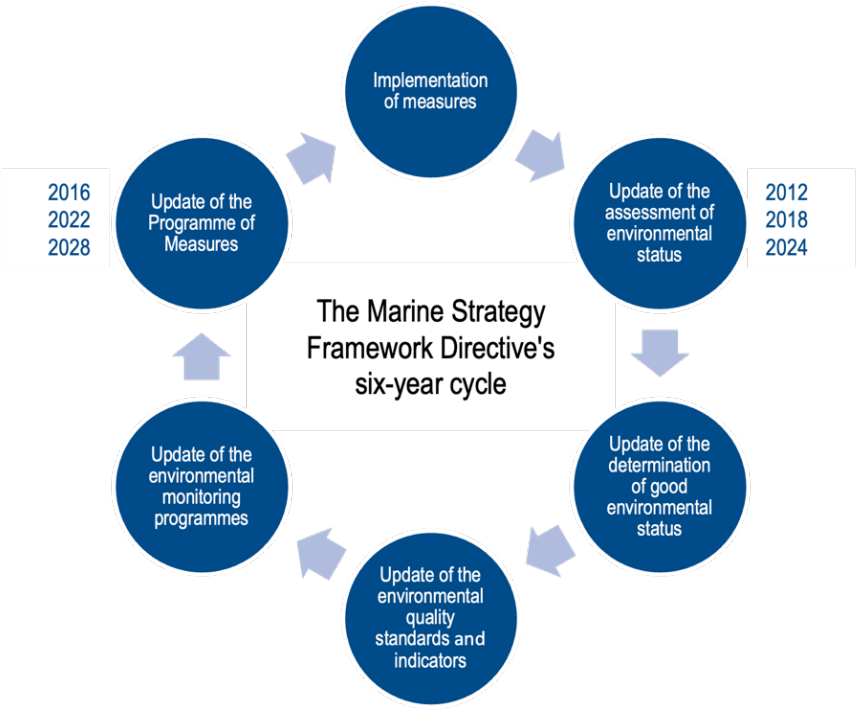

Figure 1. The figure illustrates the MSFD management cycle, which includes the implementation and development of measures for the marine environment. Years are shown for existing and future assessments of environmental status and for updating the Programme of Measures.

Good environmental status is defined by MSFD descriptors in SwAM's regulations HVMFS 2012:18. Each descriptor is linked to indicators with associated threshold values indicating, for example, the population size, the level of hazardous substances, or the depth of visibility that has been deemed to be consistent with good environmental status. To achieve this status, the Targets according to article 10 of the MSFD are in Sweden

implemented as Environmental Quality Standards (EQS) (SFS 2010:1341). The EQSs for the marine environment specify, for example, levels of pressure that may not be exceeded or a required direction of change for pressures that have been assessed as affecting the marine environment (HVMFS 2012:18, Appendix 3). The main purpose of the Swedish PoM is to implement measures that enable compliance with the EQSs. If compliance with the EQSs is achieved, it is assumed that the condition defined as good environmental status can also be achieved in the long term. The state of the marine environment and compliance with the EQSs are assessed every six years. The most recent assessment of the state of the environment in Swedish seas, published in 2018, shows that the objectives for many species and habitats are not being achieved, while the pressure on the sea from several human activities is increasing (SwAM 2018). The next assessment of the state of the marine environment will be published in 2024.

The second Swedish PoM for the marine environment contains 44 measures. Thirty of these are measures remaining from the first PoM 2016–2021, of which nine have been modified, and 14 measures are new (SwAM 2021). Thematically, the measures aim to reduce pressures from human activities in the coastal and marine area and include hazardous substances, nutrients, impacts from fishing, underwater noise, invasive species, impacts on hydrographic processes, and marine litter. The PoM also includes measures to protect and restore marine habitats and food webs.

The PoM includes both physical measures and policy instruments such as raising awareness, economic incentives and new or revised regulations. To support operative supervision, several guidelines for inspection and enforcement are also developed as part of the PoM. Knowledge building is another common type of measure, often combined with other types. Section 4.1 describes the types of measures in more detail. Several national authorities, County Administrative Boards and municipalities are responsible for implementing the measures.

The Swedish PoM is intended to complement other policy instruments that contribute to reducing the impact of human activities on the marine environment (SwAM 2021). Viewed holistacally, this means that the Swedish PoM only covers a limited number of the measures that are implemented to improve the marine environment, and it is therefore rarely possible to link changes in environmental status and EQSs directly to measures in the PoM. For example, land-based measures that can reduce impacts on the sea, such as the supply of nutrients, are mainly decided through programmes of measures that follow from the Swedish Water Management Ordinance (SFS 2004:660), and there is extensive legislation to reduce the impacts from environmentally hazardous activities and water operations. In addition, Sweden implements measures originating from international agreements such as HELCOM, OSPAR and the International Maritime Organisation (IMO), which are sometimes, but not always, included in the PoM.

1.2. WHY EVALUATE THE PROGRAMME OF MEASURES?

The implementation of measures in environmental management aims to bring about a change in a desired direction and includes both physical measures and policy instruments aimed at changing behaviour. Decisions on new measures are usually preceded by analyses and considerations of how best to achieve the desired change. Despite such efforts, unexpected things may happen along the way. Grants are not applied for to the extent expected, information campaigns do not reach their target audience, loopholes are found to circumvent new regulations, physical measures are not as effective as expected, and so on. Following up on measures and evaluating how well they are working makes it possible to identify deviations from expected impacts and results and enables optimisations and adjustments of the measures.

According to the MSFD, adaptive management should be applied to achieve good environmental status in Europe's seas (2008/56/EC). Adaptive management means that new knowledge is used and implemented in management, including consideration of the results from evaluations of measures (Holling 1978). However, according to the current guidance document for the implementation of the MSFD, requirements for reporting on the PoMs are limited to progress in the implementation of measures (Article 18, 2008/56/EC). Countries should also share information about how environmental monitoring and indicators used to assess the environmental status and EQSs can be used to evaluate the PoMs (European Commission 2021). Evaluating the effects of individual measures is thus not required and is currently a national initiative.

In the management of the marine environment, it is particularly important to consider results from evaluations when updating the PoMs, which is done every six years. The updates provide an opportunity to adjust existing measures if necessary. Updates of the PoM also require information on the effects of existing measures in order to assess the need for further measures. The next update of the Swedish PoM will take place in 2028.

Evaluation of individual measures in the PoM does not necessarily have to take place at the same periodicity as the updating of the PoM. When it comes to environmental effects, doing so could even be pointless, due to expected time lags in the effects of certain measures. Rather, evaluation should be seen as a continuous process, the timing of which depends on the measure, but which should, where possible, be adapted to specific management needs.

2. PROJECT DESCRIPTION AND METHODOLOGY

2.1. OBJECTIVE

The project objective was to provide a proposal on how to strengthen the follow-up and evaluation of the effects of the measures in the Swedish Programme of Measures (PoM) for the marine environment. This included:

- identifying any gaps in the follow-up of measures;
- proposing methods for evaluating the effects of measures; and
- making suggestions on how to improve the existing follow-up and evaluation of measures.

The project was also tasked with identifying existing sources of information on the effects of measures in the Swedish PoM, and with proposing how SwAM can gather information on the effects of measures. The results of these tasks are included in the Swedish version of this report.

2.2. BACKGROUND MATERIAL

Background material and documentation from the Swedish Agency for Marine and Water Management (SwAM) consisted of the following:

Programme of Measures for the marine environment

Report from SwAM 2021: *Marin strategi för Nordsjön och Östersjön. Åtgärdsprogram för havsmiljön 2022–2027 enligt havsmiljöförordningen*. *Rapport 2021:20*. (In English: Marine Strategy for the North Sea and the Baltic Sea. Programme of Measures for the marine environment 2022–2027).

Reports from the authorities responsible for implementation of individual measures

The reporting by responsible authorities consists of a narrative description of the implementation during 2019–2021, for example, information on reports that have been produced, whether new regulations have been adopted, or whether planned information campaigns have been carried out. The responsible authorities are also asked to estimate the time that the authority has allocated for the implementation of the measure, costs of external consultants, and any co-financing from the EU. Reporting by the implementing authorities is part of an internal working material at SwAM that was made available to the project group.

Fact sheets for each measure in the PoM

Fact sheets for each measure are decided at the time of the adoption of the PoM and are available on SwAM's website[2] and in the report for the Swedish PoM 2022–2027 (SwAM 2021). The fact sheets provide justifications for the measure, a description of

[2] https://www.havochvatten.se/planering-forvaltning-och-samverkan/havsmiljoforvaltning/atgardsprogram-for-havsmiljon-i-nordsjon-och-ostersjon/atgardsfaktablad.html (in Swedish)

what the measure is intended to achieve, an account of the environmental objectives and EQSs that the measure will help to achieve, the laws and regulations that relate to the measure, and in some cases a preliminary description of how the measure can be followed up and evaluated. However, most fact sheets state that the follow-up of effects of the measures will be specified in "implementation plans", which should be produced by the authority responsible for each measure.

Implementation plans for a limited number of measures in the PoM

The implementation plans were still under development during the project. Nineteen draft plans were made available to the project group. The implementation plans contain brief information on the activities planned to implement the measure, a timetable and resource requirements, the status of the implementation of the measure, products of the measure such as reports, and in some cases, a brief description of how the effects of the measure are intended to be followed up. The latter are divided by SwAM into "administrative effects" and "environmental effects". At the time of the project, proposals for follow up or evaluation of environmental effects were described in all implementation plans, while follow-up of administrative effects was described for eight measures. Once the implementation plans are considered to be sufficiently developed, they will be made available on SwAM's website.

Other material

The project has also collected the products produced by responsible authorities as part of the implementation of measures in the PoM, such as syntheses, guidelines, and evaluations. This was done by web searches and through personal contact with the authorities responsible for individual measures in the PoM.

In Chapter 4, which gives examples of how to evaluate individual measures in the PoM, background information on the measures was also obtained from other sources, such as articles, reports, websites, etc., as referred to in the text.

2.3. ANALYSES AND PROJECT DELIMITATIONS

The proposals and recommendations presented in the report are based on the following reviews and analyses.

Analysis of the concept of "administrative effects" and the SwAM evaluation model

The Swedish Agency for Marine and Water Management proposes that an evaluation of administrative effects and environmental effects could provide a basis for following up measures in the PoM. An analysis of the concept of "administrative effects" together with a review of established approaches to evaluating measures, primarily programme theory (see, for example, Vedung 2009, Mayne 2015), led to the development of an extended evaluation model and a proposal for a framework for the follow-up and evaluation of the PoM as presented in Chapter 3. The extended model formed the basis for the examples of evaluation of measures in the PoM which are presented in Chapter 4.

Review of documentation

An overall review of facts sheets, reporting and implementation plans was carried out for all 44 measures in the PoM. In addition, in-depth reviews were carried out for 14 measures, seven of which are also examples discussed in greater detail in Chapter 4. The examples given in Chapter 4 were selected to represent some of the most common measure types (economic instruments, regulations, information campaigns, development of guidelines) and different thematic areas (eutrophication, invasive species, hazardous substances, impact from fishing, marine litter). The in-depth review examined, among other things, how well the purpose and expected effect chains of the measures are described, whether it is clear who the target group(s) of the measure is (are), whether the use of concepts is consistent, and whether proposed methods for follow-up and evaluation seem adequate for estimating the effects of the measures. The results of the review are reflected in the examples of how follow-up and evaluation can be carried out (section 4.4).

Categorisation of measure types

The measures in the PoM were grouped into 11 general measure types, which are presented in section 4.1 and Appendix 1. The measure types provided a basis for exemplifying different types of methods that may be appropriate for follow-up and evaluation. The full list of measures is set out in Appendix 1. Individual measures in the Swedish PoM are denoted with "ÅPH" followed by a number.

Expert-based proposals for evaluation methods

Proposals for possible methods for follow-up and evaluation are mainly based on expert judgements by the project and were discussed jointly at the project group meetings. Since there is already a mechanism for evaluating the overall effect of measures on the marine environment, through the follow-up of environmental status and EQSs, the project has focused on how the effect of individual measures can be evaluated using the proposed evaluation model (Chapter 3). Section 4.3 gives examples of possible evaluation methods for different types of measures, and section 4.4 includes proposals of methods for a selection of specific measures in the Swedish PoM.

2.4. DEFINITIONS

Many of the terms used in the report are defined in different ways, both in the scientific literature and by Swedish authorities responsible for environmental management. Moreover, definitions are often contextual. The definitions of the concepts used in this report should be read in the context of the implementation and evaluation of measures. The concepts are discussed in more detail in the sections where they are used in the report. In short, key concepts are used as follows:

Activity	The work undertaken within one or more authorities to implement a measure.
Actor	Individual, company, organisation, or authority acting in relation to the PoM.
Behavioural change	Changes in the behaviour of actors outside the administration. Includes new behaviours, changes, or discontinuations of previous behaviours, as well as increased or decreased frequency of behaviours.
Effect	A change that has occurred as a result of a measure that would not have occurred otherwise.
Effectiveness	The degree of fulfilment of goals. In organisational theory and economic analysis, achievement of goals is related to the use of resources.
Environmental effect	A change in the status of the environment or level of pressure on the environment resulting from a measure. In this report, the term is limited to effects that are quantifiable in the environment.
Evaluation	An ex-post assessment and evaluation of collected data to achieve a deeper understanding and guidance for further action. An evaluation includes a preceding follow-up.
Follow-up	Collection and recording of data without in-depth analysis.
Human activities	Unless otherwise stated, this refers to human activities acting in or potentially affecting the marine environment, see for example Marine Strategy Framework Directive Annex 3, Table 2b (2008/56/EC).
Administrative effect	A change that would not occur without the output and activities of an authority.
Measure	A physical measure or policy instrument.

Output	A tangible result of the activities of the administration such as products or services, e.g. new or revised guidelines, plans, management tools, regulations, payment of grants.
Physical measure	A measure aimed at improving environmental status or reducing the impact at a specific site or area, such as habitat restoration, remediation of contaminated sediments, technical installations to reduce emissions from human activities, etc.
Policy instruments	A measure intended to influence the behaviour of actors in a direction desired by the governing body. Common examples of policy instruments in environmental management include administrative (e.g., laws, regulations, inspection, and enforcement), economic (e.g., subsidies, grants) and information (e.g., awareness raising campaigns, eco-labelling).
Side effect	An effect other than the one(s) intended. Side effects can be both positive and negative.
Supervision	Supervision is carried out to oversee compliance with requirements set out in legislation and requirements set out in permits. This covers inspections, enforcement, and the issuing of guidelines. Supervision is carried out by certain supervisory authorities.
Supervisory guidelines	Guidelines for authorities responsible for the operative supervision, e.g., inspection and enforcement.

3. DEVELOPMENT OF AN EVALUATION MODEL

In this chapter, we describe how follow-up and evaluation of measures in the Swedish Programme of Measures for the marine environment can be developed.

A general key point is that the terms follow-up and evaluation describe different types of activities. In Swedish public administration, follow-up usually involves simple data collection and is not linked to any advanced analysis of causal relationships (Vedung 2009). A variation of follow-up is what is known as "qualified follow-up", which involves the monitoring of a process, including examining factors that may facilitate or hinder that process. Evaluation is defined as a thorough ex-post assessment of output, final outcomes, management and decision-making content, and the organisation of public activities (Vedung 2009, p. 35). This corresponds to the English term "programme evaluation" (Owen 2006), which includes the measurement of effects.

In the public sector, evaluation models are commonly based on the idea of the resource transformation chain, where a resource or input is transformed into an outcome in some process (an organisation, administration). This outcome is often referred to as a product or output. The output then leads to effects in one or more steps, which may be different for different target groups. The chain is also based on ideas and assumptions about how the different parts affect each other, i.e., a kind of theory of causal relationships that links interventions to effects. This is known as programme theory and forms the basis of how the evaluator views the phenomenon being evaluated.

The Swedish Agency for Marine and Water Management (SwAM) proposes dividing effects into administrative effects and environmental effects. This distinction is thus part of SwAM's programme theory and constitutes part of the structure of the follow-up and evaluation of the PoM. However, this division into administrative effects and environmental effects is not established in the evaluation literature, or in the general conceptual apparatus associated with evaluation. The chapter therefore begins by discussing what the concept of administrative effects covers and how it is used by SwAM, followed by a proposal for an evaluation model.

3.1. WHAT ARE ADMINISTRATIVE EFFECTS?

In the draft implementation plans reviewed by the project, SwAM defines administrative effects as follows:

"Administrative effects: effects/changes resulting from the authorities' own outputs (short term...). Examples include the effect of an authority's guidance or development of guidelines (guidance or guidelines is an output)".

The origin of the concept, as used by SwAM, can be traced back to a report written by the Academy of Management Accounting and Control in Central Government at Stockholm University in 2005.

The report was the result of a case study of the Swedish Environmental Protection Agency's work on steering other actors towards desired effects and taking responsibility for these (Grönlund et al. 2005).

The theoretical basis for the concept of administrative effect is based on the notion of the resource transformation chain of organisations, whereby resources are transformed through the organisational work process into outputs that then produce some kind of effect. The relationship between resource and output is called productivity. In a simple example taken from industrial production, productivity is the number of units of goods produced. In government, output is, for example, the number of cases that have been handled or number of investigations carried out.

Effectiveness is a broader concept that refers to the overall purpose of activities and outputs, which is often the achievement of pre-established objectives. An output can also be formulated as a goal, but then becomes the same as productivity. In the public sector, such productivity goals are common and are often quantitative, such as the number of doctor visits, the number of investigations carried out or the number of checks for driving under the influence of alcohol. This way of measuring public sector activities has been criticised for promoting practices that are steered towards achieving quantities instead of focusing on quality (Öberg & Sundström 2020).

Grönlund et al. (2005) define effects as "...changes in a state that would not have occurred without the work of the authority". At the same time, it is difficult to measure effects that are not purely quantitative. According to the mentioned study, this is particularly challenging when many actors contribute to outputs that result in an effect, and the author therefore argues that the concept "effect" should be divided into administrative effects and environmental effects. In this suggested division, "administrative effect" refers to changes resulting from the output of an authority, which in turn has an effect on the environment. Examples of outputs cited in the study include handbooks, regulations, or fact sheets. Administrative effects are in turn exemplified as compliance with legislation, increased knowledge of legislation or increased opportunities for evaluation. According to Grönlund et al. (2005), administrative effects can be said to answer the question: given the change in the state of the environment between two points in time, to what extent has the output of individual authorities contributed to the change? While such links are unlikely to be verifiable, we have chosen to retain the concept of administrative effects as an intermediate step in the proposed evaluation model. In the following chapters, we provide examples of what is meant in the model.

3.2. PROPOSAL FOR A FRAMEWORK FOR FOLLOW-UP AND EVALUATION OF MEASURES

Based on literature on evaluation and with examples from Swedish implementation plans, we propose an extended effect chain and a framework that can contribute to improved follow-up and evaluation of individual measures in the PoM. A key difference compared

with Grönlund et al. (2005) and the current approach of SwAM and our proposed evaluation model, is that we make a distinction between three aspects resulting from the activities and output of the authorities: administrative effects, behavioural changes, and environmental effects. Separating these aspects makes the chain of effects clearer, and it becomes possible to evaluate different types of effects of the measures. This section clarifies our definition of these concepts. Examples of how the model can be used to evaluate measures in the PoM are given in Chapter 4.

3.2.1. The evaluation model

The extended model consists of six steps: agreement on a measure – implementation of the measure by an authority – output from the authority – administrative effect – behavioural change – environmental effect (Figure 2). The proposals for different evaluation methods presented in this report relate to the output from the authority and onwards in the effect chain. The evaluation of the administration's activities is also relevant but is not included as a step in the evaluation of the effects of the PoM. The effect chain is illustrated in the figure below:

Figure 2: Proposed basic evaluation model for measures in the PoM. The process starts in the administration, where activities to implement a decided measure are undertaken.

HMeasure

The first component in the effect chain is the agreed measure itself. This includes a description of the purpose of the measure, how it will be implemented and by whom, etc. Appendix 1 contains a list of the measures in the Swedish PoM. One example is "To follow up and develop support and guidance for municipal and regional marine and coastal planning under the Planning and Building Act (ÅPH 14)".

Implementation in the administration

The second step includes the activities that are carried out in the administration by the authority responsible for the measure in question. This is where the measure is implemented and where a result is produced, i.e., the process leading to an output.

Output

The result of the administration's activities is called an output,[3] which is an established term used in evaluating the effects of public policy (Knoepfel et al. 2007). This output can, for example, be the production of handbooks, guidelines or procedures, or the implementation of information initiatives.

[3] Note that in Swedish this is commonly referred to as "prestation", see e.g. ESV 2016 (ESV: Ekonomistyrningsverket, Swedish National Financial Management Authority).

Administrative effect

In the next step, the output should lead to some kind of result, which is called an administrative effect in the model. For example, guidelines for authorities responsible for operative supervision resulting in more consistent inspection and enforcement, or a knowledge-building activity resulting in increased awareness in the target group.

Administrative effects can occur in several steps. For example, a management measure may be designed to influence the work of another authority and will thus have an effect at a later stage. Administrative effects can also be of different character. In the draft implementation plans for measures in the Swedish PoM that were available to the project, the intended administrative effects were occasionally specified, i.e., what the activities in the administration are intended to achieve.

Behavioural change

The effects of policy measures generally involve bringing about some form of behavioural change in a target group, which in turn affects the state of the environment. This means that when formulating the effect chain, there must be one or more assumptions about the relationship between the administrative effect, the behavioural change, and the environmental effect. If, for example, the output is a guideline that aims to increase consistency of management in some area, a description should also be given of how this is expected to contribute to a change in the behaviour of a target group and, in the next step, to have an effect on the environment.

Another example is a new regulation. New regulations are assumed to lead to changes in behaviour, but they can be ineffective and toothless depending on the way they are formulated or the sanctions with which they are associated.

Environmental effect

Environmental effects are what the measures in the PoM ultimately aim to achieve. In general, environmental effects are monitored using indicators to measure changes in relation to agreed goals for environmental status and pressures on the environment. However, for an individual measure, it is often difficult to link an effect measured in the environment to previous steps in the effect chain. We return to this issue in the examples given in Chapter 4.

3.2.2. Other aspects of the framework

In addition to the components of the model described above, there are other aspects that should be considered when formulating the effect chain and evaluating measures, including side effects and assumptions.

Side effects

There are always different types of possible side effects in an effect chain. These side effects can exist alongside the intended administrative effects, as well as alongside behavioural changes and environmental effects.

The side effects of administrative effects may involve changes in the administration's own activities such as:

- Administration: for example, if a system is to be developed, or other procedures put in place.
- Costs: costs incurred in producing outputs.
- Reorganisation: changes in the organisation resulting from the measures.
- Staff: if someone needs to be recruited or hired.

If the measure is a new fishing regulation, an example of unintended behavioural change by the target group of the measure could be the exploitation of new marine areas in ways that were not expected. Side effects in addition to the intended environmental effect may be a fish population that is strengthened by the measure ends up out-competing other species. Side effects can be both positive and negative and can also include interactions between measures within a programme of measures (Figure 3).

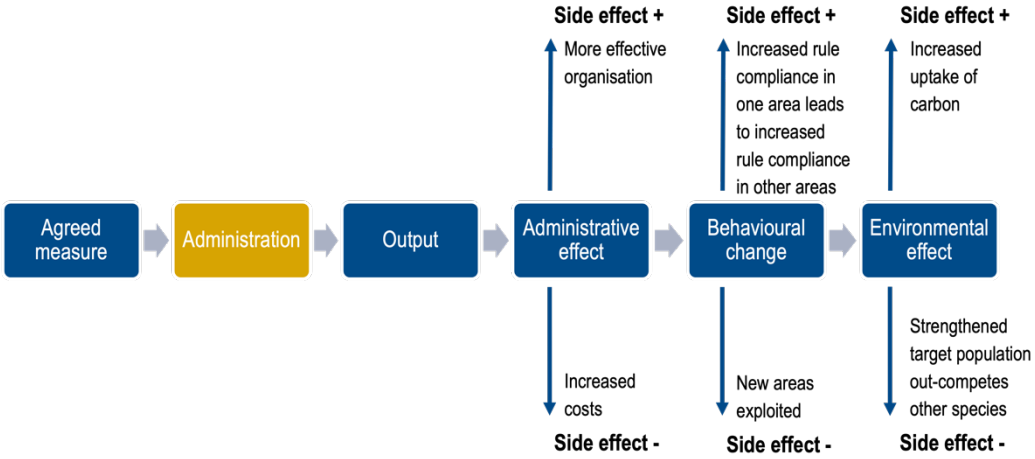

Figure 3: Examples of side effects that can occur at different stages of the impact chain.

Assumptions

To understand how a measure is intended to work, it necessary to describe both the expected effects and the assumptions made when developing the effect chain. A description of the effect chain should therefore include an account of what is required for the steps in the effect chain to function and deliver the intended effect (Mayne 2015). The expected administrative effect of a guidance document may, for example, be to increase the knowledge of a target group. However, for such an effect to occur, the guidance document must reach and be used by the target group.

The evaluation should therefore examine both the expected effect and the assumptions made (Figure 4). This is what was referred to above as programme theory, i.e., an account of the relationships in the effect chain and the factors that may affect them.

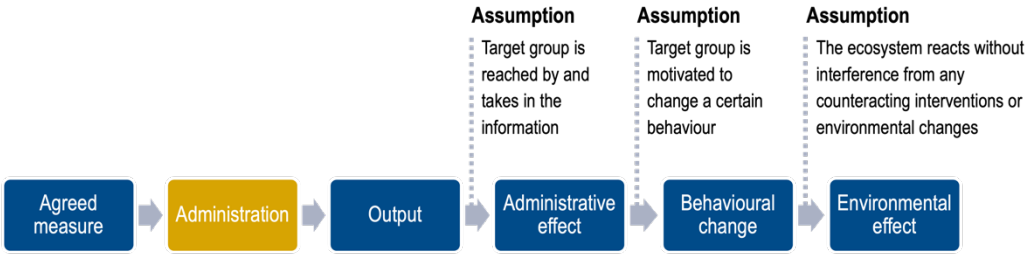

Figure 4: Examples of assumptions made in parts of the impact chain.

3.3. COMMENTARY

Our proposed framework for follow-up and evaluation (Figure 2) provides an overview of how the measure is expected to work and can help to identify the type of evaluation method that should be considered. The framework can also highlight the need to consider possible side effects of the measures.

By following the different steps in the model, and clarifying the assumptions made about the causal link between them, a more coherent programme theory can be formulated in which measures and effects are linked. We propose that the evaluation is carried out stepwise, i.e., that an assessment of administrative effects is carried out first, before behavioural changes and environmental effects are evaluated. In cases where the evaluation shows that the administrative effects are small or absent, no effect can be expected in subsequent steps and further evaluation of effects is thus unwarranted. This approach can contribute to a more resource-efficient evaluation and provide an opportunity to adjust measures that do not result in intended effects.

4. PROPOSED METHODS FOR EVALUATION

The recommendations from the project include proposals for methods to follow up and evaluate individual measures. In this chapter, we first present different types of measures in the Swedish Programme of Measures (PoM) for the marine environment, followed by a brief reflection on potentially suitable qualitative and quantitative evaluation methods. Possible methods for follow-up and evaluation are then presented at a general level for different types of measures as well as in more detail for a selection of specific measures in the Swedish PoM. The proposed methods are based on the expert judgements of the project group.

4.1. TYPES OF MEASURES IN THE SWEDISH POM

To facilitate proposing evaluation methods, the project identified and categorised several measure types, based on the available background information on the measures in the Swedish PoM. This section describes the different categories. A total of 11 measure types were identified, of which 10 can be considered to be main measure types. Technical guidelines and regulations are the most common types of measures in the Swedish PoM (Figure 5). A list of individual measures is included in Appendix 1. Individual measures in the Swedish PoM are labelled "ÅPH" followed by a number.

Note that what is defined as a measure in the Swedish PoM can consist of several measure types. Note also that these measure types are compatible with but do not directly correspond to the description of measures in the guidance for reporting of MSFD PoMs (European Commission 2018a).

Raising awareness

In this context, raising awareness is an activity aimed at the public or specific professional groups to increase their knowledge and understanding of a particular issue. Examples of such activities include information campaigns and courses on lost fishing gear and marine litter, the importance of coastal environments for the ecosystem, fishing regulations, the impact of shipping on the marine environment and exhaust emissions from two-stroke engines. Awareness-raising activities are usually combined with other types of measures such as economic instruments and stricter regulation.

Economic instruments

In the Swedish PoM, economic instruments include financial support and grants to stimulate new behaviour as well as fees and pricing of/premiums on certain goods. Such measures may include, for example, support for the development and use of aquaculture techniques with reduced environmental impact, increased funding for inspection of polluted areas, reduced prices or subsidies for the purchase and installation of certain equipment, co-financing of beach cleaning projects and the introduction of environmentally differentiated charges.

In some cases, the measures involve exploring future use of economic instruments, and in others, allocating available funds in such a way as to improve the chances of achieving environmental objectives in a particular thematic area.

Legislation

Measures aimed at investigating the need for new legislation, formulating and introducing new rules or reformulating existing legislation have been categorised under this type of measure. Measures may include, for example, establishing new marine protected areas, introducing or amending fishing regulations, tightening the legislative framework for the introduction of new vessel capacity, reformulating legislation for the labelling and marking of fishing gear, or investigating the need for stricter laws to limit the use of biocidal paints.

Physical measure

This measure type includes activities in which physical measures are carried out, such as restoration or conservation measures. Only two measures in the Swedish PoM (ÅPH 31 and 46), under the thematic areas "Restoration" and "Marine food webs", include physical measures.

Technical guidance

Technical guidelines are intended to support businesses, municipalities, County Administrative Boards and other authorities in deciding on technical measures. Among other things, the guidance may clarify applicable legislation at national and EU level, appropriate technology for implementation of measures, and the standards to be followed. Activities that fall under this measure type may include the development of guidance on measures to reduce eutrophication, appropriate methods for measuring underwater noise and recovering lost fishing gear, or improved guidance for regional and municipal marine and coastal planning.

Guidance on inspection and enforcement (supervisory guidance)

Unlike technical guidance, this type of measure includes activities aimed at developing or improving inspection and enforcement work and is therefore specifically addressed to authorities responsible for operative supervision. In several cases, the measures in the PoM include the development of both guidance for inspection and technical guidance. Examples of activities under this measure type are the development of guidance for the enforcement of cleaning of ships' hulls and the marketing of biocidal paints.

Knowledge building

This type of measure includes activities aimed at increasing knowledge within relevant authorities, County Administrative Boards and municipalities. We have therefore made a distinction between this type of measure and measures aimed at increasing the knowledge of the public (see "Awareness raising"). Examples of knowledge building measures are syntheses to increase knowledge of appropriate technical solutions, consultation with

supervisory authorities, gathering of experiences within the authorities concerned and the development of knowledge building and training programmes for personnel working in relevant areas. It is common for knowledge-building measures to be combined with other types of measures.

Digital tool

This type of measure includes activities aimed at developing digital solutions as management tools. Examples include a digital system for reporting observations of aquatic species[4] and the further development of an existing reporting system for lost fishing gear.[5]

Method development

Method development refers to activities aimed at developing new or improving existing methods for inspection, analysis, management, or technical measures. Examples include the development of methods for environmental risk assessments for product authorisation of biocidal paints and for the control and reduction of invasive species, improved methods for ecological compensation and restoration, and the development and establishment of inter-agency expert support, ecosystem-based marine management platforms or management councils.

Reporting

In one case (ÅPH 32), the sole purpose of the measure is described as the annual reporting on the implementation of measures by the authorities, municipalities and County Administrative Boards that are responsible for measures in the PoM (e.g. activities carried out, costs and following up impact). This can be regarded as a special case, as reporting generally constitutes one activity among many in the other types of measures described.

Programme of measures

In two cases (ÅPH 24 and ÅPH 29), the actual measure concerns the development of programmes of measures or action plans for specific thematic areas where more intensive work is required. The programmes of measures to be developed in the framework of the Swedish PoM concern the protection of threatened species and habitats, which falls under the thematic area “Biodiversity”, and biological restoration in coastal waters.

[4] Rappen. https://rapportera.artfakta.se/eftersokta/rappen/taxa
[5] GhostGuard. https://ghostguard.havochvatten.se/ghostguard/

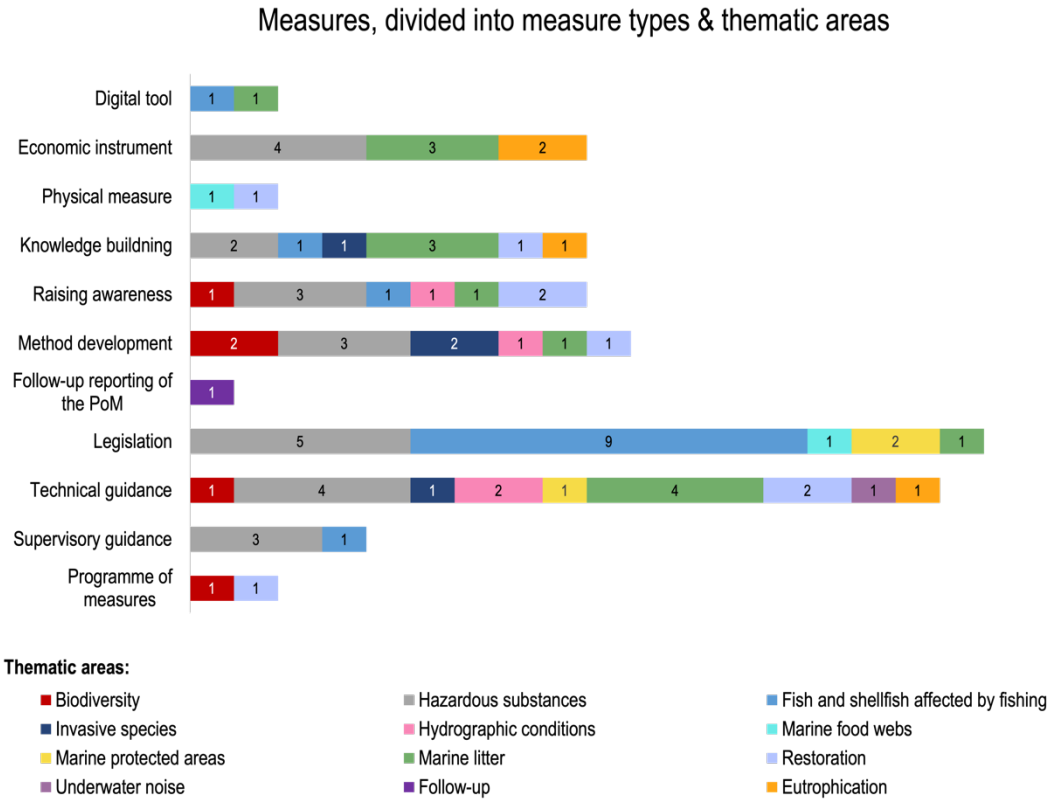

Figure 5. The figure shows the number of types of measures in the Swedish PoM 2022–2027 and the thematic areas in which these types of measures fall. What is referred to as a measure in the PoM can include several of these types of measures, usually 1–4. The figure aims to illustrate which types of measures are most common and to which thematic areas they belong. The categorisation of measure types per measure is shown in Appendix 1.

4.2. QUALITATIVE AND QUANTITATIVE METHODS

Different methods are used in evaluation, often divided into quantitative and qualitative methods. Put simply, the difference between quantitative and qualitative methods is that quantitative methods use numbers and measurements to compare the status before and after an intervention, or to compare different areas, while qualitative methods go more in depth and focus on understanding how a process develops, for example. Another distinction may be that qualitative methods are based more on the perspective of the object of study, while quantitative methods are based more on predetermined dimensions and categories (Alvesson & Sköldberg 1994).

Common quantitative methods include various statistical or correlation analyses, which may be based on the collection of environmental data or surveys aiming to achieve a representative sample. Qualitative methods are mainly represented by interviews, participant observation, document analysis and various interpretative methods, where the

evaluator is part of the social context. It is often appropriate to use a combination of quantitative and qualitative methods, known as mixed methods evaluation (Chen 2006).

The appropriate evaluation method depends on the measure being evaluated, the context in which the evaluation is being conducted, and the situation. A choice of an appropriate mix of methods therefore needs to be made for each individual measure and evaluation. Different methods may also be appropriate at different steps of the evaluation.

In terms of the division between administrative and environmental effects, qualitative methods are usually more appropriate for evaluating administrative effects. This is because administrative effects can be difficult to measure and evaluate quantitatively. Quantitative evaluation methods are generally more appropriate when assessing environmental effects.

A quantitative estimate of the expected or achieved environmental effects of a measure or a set of measures is also a prerequisite for making an economic evaluation of the measure.[6] This applies to both cost-benefit and cost-effectiveness analyses. In a social or economic cost-benefit analysis, the economic value of the achieved environmental effect and any other positive effects of the measure must be weighed against the economic costs of the measure. Such an assessment therefore requires, not only an estimate of the environmental effect achieved, but also an estimate of the economic benefit of that effect. In the context of marine management, it is more common to require economic cost-effectiveness analyses, where the economic cost of a particular measure (including the cost of negative side effects of the measure) is compared with the costs of other measures that could have been used to achieve the same environmental effect. In such assessments, it is also crucial to know the environmental effect that is achieved by a particular measure.

4.3. EXAMPLES OF METHODS FOR FOLLOW-UP AND EVALUATION OF DIFFERENT TYPES OF MEASURES

The measures in the PoM relate to different themes and may include several different types of measures. This variation reflects the need for different types and combinations of measures to achieve good environmental status. As a result, several different methods may also be appropriate for follow-up and evaluation. However, the types of measures identified in the PoM, as described in section 4.1, can to some extent be followed up and evaluated using similar approaches. Since what is referred to as a measure in the PoM may include several types of measures (see Figure 5 and Appendix 1), this also means that it may be relevant to apply several different types of methods and evaluation questions to one and the same measure.

[6] According to section 25(8) of the Marine Environmental Regulation (2010:1341), programmes of measures for the marine environment are required to include assessments of both the economic and the environmental consequences of each measure. In practice, this means that both impact analyses and cost-effectiveness analyses must be produced, which is why socio-economic analyses are highlighted in this section.

Table 1 shows a selection of measure types together with an overview of possible methods for follow-up and evaluation for each type. Preferably, measures should be evaluated in a way that makes it possible to verify whether the assumptions that were made when the effect chain was formulated have been met. As mentioned in Chapter 3, there is often an initial need to follow up whether the measure has been initiated or implemented. The results of the follow-up can be presented as output statistics from the responsible authority and, in general, there should be no need for in-depth evaluation in this step. The subsequent steps follow a chain of effects that affect different parts of society. For most measures, it is reasonable to first evaluate whether the output of the responsible authority has reached the target group. If this is not the case, no administrative effects can be expected. The next step is to evaluate whether the target group shows the behavioural changes necessary for the measure to produce the expected positive environmental effect. Finally, it is of value to know whether the objective of good environmental status has been achieved or at least whether the distance to good environmental status has been reduced.

The table makes it clear that if the previous steps and assumptions are not met, the measures cannot be expected to have an environmental effect. One exception is physical restoration which does not necessarily depend on a change in human behaviour. Clarifying the different steps is particularly important for the evaluation of measures that are expected to have slow response times in the environment, as it is important to evaluate whether the management is on the right track, or whether something needs to be modified, without having to wait for measurable effects in the environment. Evaluations of administrative effects or behavioural changes can often be expected to enable faster feedback on the performance of the measure and may be less costly than evaluating environmental effects. Another example is that evaluations of behavioural change may allow for relatively early detection of side effects of the measure, for example if the expected behavioural change is not achieved and is replaced by an alternative behaviour that does not have the expected positive environmental effect. Ideally, the evaluation of environmental effects, and any side effects, should be reflected in environmental status assessments and integrated into environmental monitoring programmes. In most cases however, it is necessary to design specific monitoring programmes to assess environmental effects of measures, for example because the scale of the effects does not match the design of environmental monitoring, or because there is a particular need to increase knowledge about a specific measure.

Measure types such as knowledge building, digital tools and method development are intended to improve the basis for management and are not expected to result in changes in behaviour or in environmental effects unless they are used as a basis for further measures. We therefore propose a limited follow-up of the output of such measures through an evaluation of administrative effects, to check whether the information produced or collected is being used as expected.

The development of specific programmes of measures in the Swedish PoM, for example to protect threatened species, has not been included in the table. The specific programmes of measures have been categorised as a single measure type in this project but often include several individual measures. In this case, the individual measures should be evaluated separately, and the effectiveness of the programme as a whole should be evaluated in relation to the objectives set for the specific programme.

Table 1. Overview of a selection of types of measures and possible ways of carrying out follow-up and evaluation. For each type of measure, examples are given of possible assumptions that can be made for the effect chain to be realised and examples of methods for follow-up and evaluation.

DIFFERENT STEPS IN THE EVALUATION PROCESS

		Follow-up of output *Takes place within the responsible authority*	**Evaluation of administrative effects** *Takes place in society*	**Evaluation of behavioural changes** *Takes place in society*	**Evaluation of environmental effects** *Takes place in the environment*
Guidelines for inspection and enforcement (supervisory guidance)	Assumption	Guidelines developed	The guidelines are known to the authority responsible for operative supervision, are considered useful and are used.	The guidelines have resulted in behavioural changes in the target group for inspection and enforcement.	The guidelines have had the intended effect on the environment.
	Method	Registration and documentation of guidelines	Qualitative – interviews, document analysis Quantitative – surveys, information from inspection and enforcement cases	Qualitative – interviews with target group Quantitative – information from enforcement cases, analysing data directly linked to the guidance, e.g., amount of hazardous substances being collected	Difficult to evaluate environmental effects of individual supervisory guidelines. Specific variables need to be identified and monitored, possibly with dedicated monitoring programmes.
Technical guidelines	Assumption	Guidelines developed	The guidelines are known to the target audience, are considered useful and are used.	The guidelines have resulted in expected behavioural changes in the target group for the guidance.	The guidelines have had the intended impact on the environment.
	Method	Registration and documentation of guidelines	Qualitative – interviews, document analysis Quantitative – surveys, information from enforcement cases	Qualitative – interviews with target group Quantitative – information from permit and licence applications, analysis of data directly linked to the guidance e.g., use of more environmentally friendly technologies	Difficult to evaluate environmental effects of individual technical guidance documents. Specific variables need to be identified and monitored, possibly with dedicated monitoring programmes.

		Follow-up of output *Takes place within the responsible authority*	**Evaluation of administrative effects** *Takes place in society*	**Evaluation of behavioural changes** *Takes place in society*	**Evaluation of environmental effects** *Takes place in the environment*
Awareness raising	Assumption	Information campaign carried out	The information campaign has reached the intended target group, and the intended message has been received.	The information campaign has resulted in expected behavioural changes in the target group.	The information campaign has had the desired effect on the environment.
	Method	Registration and documentation of information campaign	Qualitative – interviews with target group Quantitative – surveys addressed to the target group	Qualitative – interviews with target group Quantitative – analysis of data directly linked to the awareness raising measures e.g., amount of litter collected, analysis of consumption patterns	Difficult to evaluate environmental effects of individual information initiatives, the possibility to do so has to be assessed in each case.
Regulation *Example: fisheries regulation*	Assumption	New or updated regulation adopted	Inspection and enforcement have been adjusted to the new regulation.	Compliance with regulations, e.g., protected areas, technical regulation of fishing, etc.	The regulation has had the intended effect on the environment, e.g., improved status of fish stocks.
	Method	Registration and documentation of regulation	Quantitative – analysing the type and extent of inspection and enforcement that can be linked to the regulation Qualitative – interviews with officials involved in enforcement activities	Quantitative – analysis of information from fisheries control and enforcement, spatial distribution of fishing activities Qualitative – interviews with fishermen	Quantitative – analysis based on dedicated monitoring programmes, e.g., monitoring programmes in selected protected areas, population estimations.

		Follow-up of output *Takes place within the responsible authority*	**Evaluation of administrative effects** *Takes place in society*	**Evaluation of behavioural changes** *Takes place in society*	**Evaluation of environmental effects** *Takes place in the environment*
Physical measures	Assumption	Approval of any necessary authorisations	The measure has been carried out	- [7]	The measure has had the intended effect on the environment. Depending on the measure, e.g., "Eelgrass meadow stores carbon and maintains biodiversity", "migration routes contribute to local fish stocks".
	Method	Registration and documentation	Make a record that the measure is complete.		Quantitative – analysis based on dedicated monitoring programmes.
Economic instrument *Example: grants to operators*	Assumption	Decisions on targeted calls for application of grants	The target group knows about calls for proposals and applies for grants.	The grant has contributed to changes in the behaviour of the target group, such as the use of more environmentally friendly technologies.	The grant has had the intended effect on the environment, e.g., reduced emissions.
	Method	Registration and documentation of output	Quantitative – compilation and analysis of grants paid out	Qualitative – interviews with target group, e.g., operators Quantitative – in-depth analysis of grants paid out	Quantitative – analysis based on dedicated monitoring programmes or estimates of impact based on established models or templates

[7] No behavioural change is expected but can be replaced by intermediate evaluation of environmental effects, e.g. "implanted eelgrass has survived and is growing", or "migration routes are used by target species".

		Follow-up of output *Takes place within the responsible authority*	**Evaluation of administrative effects** *Takes place in society*	**Evaluation of behavioural changes** *Takes place in society*	**Evaluation of environmental effects** *Takes place in the environment*
Knowledge building, methodology development	Assumption	Report/synthesis has been produced	The content of the report has been considered in decisions on further measures.	-	-
	Method	Registration and documentation of output	Qualitative – document analysis, interviews with target group	-	-
Digital tool	Assumption	The tool has been developed and launched	The tool is used by the target group and the information collected through the tool is used within the administration.	-	-
	Method	Registration and documentation of output	Qualitative – document analysis Quantitative – number of visits/reports via the website	-	-

4.4. EXAMPLES OF POSSIBLE EVALUATION OF MEASURES IN THE SWEDISH POM

This section describes possible methods for evaluating a selection of measures in the Swedish PoM, based on the evaluation model proposed in section 3.2. The cases should be seen as examples, as the design of evaluations requires more detailed information on the measures than was available to this project. A full account of the legislation affecting the measures, and links to the Swedish EQSs, can be found in the fact sheet for each measure provided by SwAM.[8]

4.4.1. Economic instrument: ÅPH 12, Stimulate aquaculture techniques which provide no net load in marine areas not achieving good environmental status

Background

The measure was adopted for the first Swedish PoM 2016–2021 and continues in 2022–2027. No implementation plan for the measure was available at the time of this project. The Swedish Board of Agriculture is responsible for implementation. The measure aims to stimulate aquaculture techniques that do not result in a net load of nutrients to the sea, especially in areas that do not achieve good environmental status. The measure is linked to the European Maritime, Fisheries and Aquaculture Fund (EMFAF) (EU 2021/1139). The call for funds is based on a national programme that is based on priorities and specific objectives of the EMFAF and that considers national needs (SFC2021 EHFVF programme[9]).

Macroalgal cultivation in the Koster Sea. Photo: Wouter Visch.

[8] https://www.havochvatten.se/planering-forvaltning-och-samverkan/havsmiljoforvaltning/atgardsprogram-for-havsmiljon-i-nordsjon-och-ostersjon/atgardsfaktablad.html (in Swedish)

[9] SFC2021 EHFVF programme. Swedish Marine, Fisheries and Aquaculture Programme. Commission Decision number C(2022)5763.

Application of the evaluation model to ÅPH 12

The website of the Swedish Board of Agriculture states that through EMFAF 2021–2027 it is possible to apply for funding for "sustainable aquaculture", which includes support for investments in sustainable aquaculture, innovation projects and skills development in aquaculture. The example below focuses on support for investments where the target group is aquaculture operators. Investments can be applied for both by existing businesses and as start-up aid for new businesses. The national EMFAF programme gives examples of the types of investments that can be supported. For sustainable aquaculture, these include investments in closed, semi-closed and recirculating aquaculture systems, which reduce nutrient emissions compared to open systems, and aquaculture of species that result in carbon and nutrient uptake. A national action plan for EMFAF 2021–2027 emphasises that investments should lead to an increase in sustainable aquaculture production (Swedish Board of Agriculture 2022). As of October 2023, there were still no calls for proposals for the theme.

Output

The EMFAF has an established evaluation mechanism at EU level which requires each Member State to establish a framework for evaluating the programme (EU 2021/1060, Article 16(1)). This includes using a selection of indicators set out in the Regulation for the EMFAF and setting targets for the indicators (EU, 2021/1139). For the evaluation of the 2021–2027 programme, these indicators include, for example, the number of projects promoting sustainable aquaculture techniques, and new production capacity (tonnes per year) (SFC2021 EHFVF programme). It is proposed that the output from activities in the administration is followed up by the indicators used for reporting to the EU. Information on production capacity should be available in project applications or could be collected by enquiries to the project owners.

Administrative effect

The intended administrative effect can be described as an increase in sustainable aquaculture production. This can be evaluated, for example, by examining changes in the number and production of farms using low environmental impact techniques that can be attributed to grants from the programme. Basic statistics on existing aquaculture operations and farming systems can be found in the Swedish Board of Agriculture's annual reports on aquaculture.[10] This could be combined with surveys to examine the target group's knowledge of the possibility of applying for grants and their interest in doing so, i.e., whether the administration has managed to reach out with information about the funding opportunity and motivate potential applicants. This is a prerequisite for the programme to contribute to increased investment in sustainable aquaculture technologies.

[10]

Changes in behaviour

To achieve environmental effects, behavioural changes are needed in the target group, i.e., aquaculture operators that are eligible for funding. Establishing or upgrading aquaculture to sustainable techniques requires an interest in applying for investment grants. Own investment is also required as the level of support from the EMFAF for investments is 40 percent of expenditure. Regarding the use of more closed cultivation systems, it has been highlighted that perhaps the most important driver for aquaculture operators is that these systems reduce parasite and pathogen infestation, and thus increase the productivity of cultivation (Eriksson et al. 2017). In addition, it has become more difficult to obtain permits for cage culture in the parts of the Baltic Sea that are severely affected by eutrophication. Thus, reducing environmental impact is not necessarily the main driver for investing in environmentally sustainable technologies. Understanding the drivers of desired behavioural change is central to the design of any policy instrument. Behavioural changes as well as barriers and drivers for change can for example be evaluated through interviews with aquaculture operators, both those who have applied for grants and those who have not.

Environmental effect

Environmental effects of the investment projects are unlikely to be detectable through national or regional environmental monitoring and would likely be costly to measure for individual aquaculture farms. However, it should be possible to calculate the expected load reductions when an aquaculture farm of a certain type and size changes technology, as models exist to calculate discharge for certain farming techniques (Eriksson et al. 2017).

4.4.2. Supervisory guidance: ÅPH 15, Develop guidance aimed at authorities and commercial operations for the disposal of contaminants and fouling in the cleaning of ship hulls

Background

The measure was adopted in 2015 and was amended in 2021 to refer only to the cleaning of ship hulls, while the cleaning of hulls of recreational vessels was moved to ÅPH 17 (see section 4.4.3). A draft implementation plan was available during this project. The Swedish Environmental Protection Agency (SEPA) is the responsible authority for developing supervisory guidelines and the target group is authorities responsible for operative supervision (municipalities and County Administrative Boards) and affected businesses. The guidelines will include a description of how the inspection should be carried out and guidelines on requirements for the management of biofouling, technologies to prevent the spread of hazardous substances and for the collection of residues from cleaning. In addition, the type of ships to be covered by the guidance will be defined.

Clinging medusa, *Gonionemus vertens*. Invasive species in Swedish waters that attaches itself to ship hulls or ends up in ballast water tanks and spreads as a stowaway to new areas. Photo: Björn Källström, GMBL.

Application of the evaluation model to ÅPH 15

The description of the measure includes information on what is to be done and what it should lead to, including behavioural changes to achieve environmental effects. The work will mainly be carried out by SEPA and SwAM, as well as the Swedish Transport Agency regarding international work.

Output

The main output of the measure is the production of a guidance document. Other planned outputs are background reports to build knowledge on the relationship between hull fouling and the introduction of invasive species and available techniques for collecting residues from hull cleaning. The achievement could be followed up by documenting that the guidance has been produced and distributed to all municipalities and County Administrative Boards and is available on the SEPA website.

Administrative effect

An expected administrative effect of the measure is that supervision is carried out in accordance with the guidance. The implementation plan also states that the background reports will lead to increased knowledge in the authorities concerned. The administrative effect of the supervisory guidance produced could, for example, be evaluated through a survey to determine whether actors involved in the inspection are aware of the content of the guidance and have a plan and acceptance for their own efforts. The survey recipients could be limited to municipalities with large harbours for commercial vessels. The evaluation should also include an evaluation of any assumptions that have been made, for example if there is an aim to achieve a certain quantitative change in inspection activities.

Changes in behaviour

The purpose of the guidelines is to ensure that relevant organisations (e.g., shipping

companies, cleaning companies, ship agents and ports) carry out hull cleaning in a way that prevents the release of removed fouling into the marine environment, and instead collects and treats it in accordance with appropriate methods. A first step in an evaluation could be to assess whether knowledge of or the contents of the guidance has reached the operators. As ship hull cleaning is only carried out by a limited number of harbours in Sweden and for few ships, such evaluation would require a relatively limited amount of work. Further follow-up and evaluation could be carried out regarding the actual behaviour during hull cleaning, and whether the need for waste reception facilities has changed, for example due to the collection of more fouling material. The evaluation could also include a comparison of the extent of the measured new behaviours, what the expected change was, including with a baseline.

Environmental effect

The aim is to use technology that reduces the risk of invasive species and hazardous substances being released during hull cleaning. The implementation plan proposes that the environmental effect can be estimated by environmental monitoring and the number of introductions of invasive species. However, it is not reasonable to link environmental monitoring data to this particular measure, as any changes measured in the environment may be due to other shipping activities, as the hulls of ships in a harbour area release hazardous substances and invasive species regardless of cleaning. It is also stated that measurements of authorised and unauthorised biocides in the vicinity of hull cleaning activities could be a method to monitor the dispersal of hazardous substances after 2027. However, it will be very difficult to reliably link potential changes to this particular measure.

An evaluation of whether the measure can potentially contribute to environmental effects can be made by sampling the fouling material collected during hull cleaning, possibly supplemented by eDNA analyses. Such analyses can indicate the extent of invasive species and hazardous substances removed from the water body and the risk of spreading invasive species from ship hulls.

4.4.3. Supervisory guidance: ÅPH 17, Reduce the spread of contaminants from recreational vessels

Background

The aim of ÅPH 17 is to reduce the spread of hazardous substances, particularly tributyltin (TBT), in the marine environment from recreational vessels. ÅPH 17 was adopted for the first Swedish PoM in 2016–2021, and updated for the 2022–2027 PoM, shifting the focus from the hulls of recreational vessels to pollution in soil and sediment. A draft implementation plan was available during this project. Accordingly, several activities are planned, including the production of technical guidance aimed at guiding operators who perform hull cleaning on recreational vessels, and supervisory guidelines that aim to support municipalities and County Administrative Boards in their operative inspection and enforcement of environmentally hazardous activities. The target group for

the guidelines is primarily municipalities, as they are responsible for inspecting this type of activities related to recreational vessels (SEPA 2023).

Ship hull with old boat bottom paint. Photo: David Clode, Unsplash.

Application of the evaluation model to ÅPH 17

The implementation will be carried out in co-operation between several authorities responsible for or working on different elements of the measure. The proposed follow-up and evaluation in this example is limited to the effects of the supervisory guidance. The Swedish Environmental Protection Agency (SEPA) is responsible for developing the guidelines.

Output

SEPA's output is the development of supervisory guidelines. A follow-up of the output should appropriately focus on whether the supervisory guidance has been produced and whether it has been made available to the target group.

Administrative effect

In the implementation plan for the measure, it is assumed that the supervisory guidelines will increase the knowledge of current legislation among supervisory authorities and will assist in the inspection and enforcement of activities related to recreational vessels. Another expected administrative effect is more effective and nationally harmonised enforcement.

It is proposed that evaluation of the supervisory guidelines be carried out using a mixed method approach consisting of qualitative and quantitative surveys in the form of surveys and interviews with officers working with environmental inspections. Such analyses can provide information regarding the focus of the municipalities' inspection, the knowledge of the inspectors, and attitudes and experiences of activities related to recreational vessels

(cf. e.g., Swedish Agency for Public Management 2014). Surveys should also be used to check whether inspection officers who work with activities related to recreational vessels are familiar with the guidance, whether the officers find the guidelines useful in inspecting soil and sediment pollution, and whether they consider that there is a need for clarification of the guidelines (see also Table 1) (see e.g. SEPA 2019). This can be complemented by document analysis of, for instance, municipal guidance documents to check for references to and consistency with the guidelines for inspection.

Changes in behaviour

The administrative effects may in turn affect how businesses and private users of recreational vessels choose between methods and products, as greater prioritisation and knowledge within the supervisory authority is likely to influence the type of support, information, and inspections that these actors receive and experience.

It may be difficult to evaluate how actors have changed their activities and behaviours based on measurements in soil and sediment, as residues from biocidal paints can persist in soil and sediment long after their use has decreased. It is therefore still appropriate to evaluate changes in behaviour by measuring existing paints on boat hulls and to map alternative methods used to protect hulls (Swedish Geotechnical Institute 2018). Information on this should be collected as part of the supervisory authority's documentation.

Environmental effect

According to the implementation plan, it is proposed that the environmental effect of ÅPH 17 be followed up through environmental monitoring of concentrations of TBT and other hazardous substances in the environment over time, and through environmental monitoring of the number of introductions of invasive species that can be attributed to human activities. However, it does not seem plausible to evaluate the environmental effects of the supervisory guidance developed under ÅPH 17, partly because it is closely linked to the technical guidance aimed at operators, and partly because changes in behaviour related to recreational vessels depend on a variety of factors in addition to the guidelines. As such, it becomes of central importance to follow up and evaluate the administrative effects of the measure, since this is what can be evaluated.

4.4.4. Awareness raising: ÅPH 20, Develop a targeted national information campaign to the public and consumers on common types of litter in the marine environment, its negative impact on the environment and the link to consumer behaviour

Background

ÅPH 20 aims to raise awareness of marine litter and microplastics among the public and to change their attitudes and behaviours when handling litter items.

The measure was adopted for the first Swedish PoM 2016–2021 and continues in the

PoM for 2022–2027. No implementation plan was available during this project. Planned activities include a recurring national opinion-forming campaign aimed at individuals/the public, to raise awareness about litter and plastic items in consumer products and of the current ban on littering under the Swedish Environmental Code.

Rubbish from beach cleaning at Vara Folkhögskola in Sivik, Lysekil municipality. Photo: West Coast Foundation.

Application of the evaluation model to ÅPH 20

SwAM is responsible for and finances the measure, while private actors are responsible for implementation (mainly the organisation Håll Sverige Rent - Keep Sweden Tidy Foundation). The fact sheet for the measure describes that the campaigns should be designed in accordance with surveys carried out by SEPA on sources and pathways of microplastics and a report prepared as part of OSPAR's regional action plan against marine litter, including microplastics.[11]

Output

The output consists of payments of grants handled by SwAM and information activities carried out by private actors.

Administrative effect

ÅPH 20 is expected to result in administrative effects through increased public awareness of the potential environmental and health risks of consumer products containing microplastics and how individuals can influence the amount of marine litter.

The measure was formulated with the assumption that information activities lead to increased knowledge, which in turn leads to changes in behaviour. However, it is

[11] https://www.ospar.org/documents?v=38018

important to distinguish between information and knowledge, as knowledge is information that has been transformed through some form of processing. The processing depends on a variety of factors (political context, rhetoric around and the media image of marine litter, personal experience, etc.), which means that it is not possible to determine whether individual information activities have led to increased knowledge (Grafström & Strand 2021).

It is, however, possible to evaluate the extent to which the information has reached the target group. Such evaluations are facilitated if clear objectives have been set out for the campaigns prior to their implementation. The objectives can be more or less specifically formulated, for example that the campaigns should reach x number of individuals/school organisations/municipalities/etc. or "as many as possible". It is suggested that the objectives are evaluated using a mix of quantitative and qualitative methods, for example by looking at the number of registrations and visits to websites used in the campaigns, recipients of newsletters or number of participants at meetings and beach clean-up events, supplemented by in-depth interviews and surveys (see e.g. Koponen 2020, MSB 2020, BRÅ 2000).

Changes in behaviour

ÅPH 20 assumes that information campaigns will lead to changes in behaviour. The desired behavioural changes are compliance with the precautionary principle, increased consumer choice of environmentally friendly alternatives and reduced littering by the public.

For information initiatives to lead to increased knowledge it is necessary to involve, engage and activate the target group (Grafström & Strand 2021). However, increased knowledge does not guarantee changed behaviour, which means that there is a need to follow up and evaluate whether the campaigns have contributed to changes in behaviour in the long term. For ÅPH 20, it is proposed that this be done through interviews and surveys targeting participants in previous campaign activities, or people in the target group of the campaign. Although it is not possible to attribute behavioural changes to individual measures, this type of qualitative evaluation can contribute to a greater understanding of how to best design public campaigns, give an idea of how individuals perceive such campaigns, and provide a basis for the responsible authority in future grant decisions.

Environmental effect

The expected environmental effects are the reduction of microplastic waste streams into the marine environment and the reduction of litter on beaches and at sea.

Quantitative measurements of, for example, the amount of litter in the sea and along the coast, or products sold containing microplastics, can provide indications of changes in behaviour and increased knowledge among the target group, but it is unlikely possible to determine how individual information initiatives contribute to environmental effects.

4.4.5. Regulation: ÅPH 28, Introduce management measures in marine protected areas

Background

The measure was adopted for the first Swedish PoM 2016–2021 and continues for the period 2022–2027. The responsible authority is the County Administrative Boards.

To ensure that conservation objectives of marine protected areas, such as Natura 2000 sites, are met, it is necessary to regulate harmful activities. Since 2021, fishing has been regulated under national fisheries legislation in around 30 marine protected areas where only Swedish fishing takes place.

In those protected areas where other EU Member States have fishing opportunities, the participating states can prepare joint recommendations. In 2021, SwAM prepared a joint recommendation on fisheries regulation in the marine protected areas Fladen, Lilla Middelgrund, Stora Middelgrund and Röde bank and Morups bank. This has been submitted to the European Commission and reviewed and approved by the Scientific, Technical and Economic Committee for Fisheries (STECF).

The introduction of fishing regulations to achieve conservation objectives in the Bratten Natura 2000 site serves here as an example to illustrate that the measure has been initiated and how evaluation of the measure is planned.

Fishing in the Gulf of Bothnia. Photo: Fredrik Öhlander, Unsplash.

Application of the evaluation model to ÅPH 28

The County Administrative Board has initially updated the knowledge base (Kilnäs 2013, Karlsson et al. 2014) and conservation plans (County Administrative Board Västra Götaland 2017) for the Natura 2000 site Bratten. On behalf of the government, SwAM has subsequently initiated a consultation process with the countries that have fishing interests in the area. When there is an agreement that sufficient information has been

collected through a consultation process, joint proposals for regulations are developed according to guidance from the European Commission (European Commission 2018b).

Monitoring and evaluating the environmental effects of fisheries regulation in marine protected areas is ongoing. The monitoring programme also includes analyses of changes in fishing patterns with the aim of evaluating how the impact of fishing has changed spatially. This makes ÅPH 28 one of the few measures in the Swedish PoM where a specific monitoring programme has been designed, and implemented in several protected areas, to evaluate the impacts of fishing and effects of fisheries exclusion.

Output

The output from the administration consists of a jointly agreed proposal for fisheries regulations that is sent to the European Commission (SwAM 2016a and 2016b). The proposal for fisheries regulations and its potential to achieve the established conservation objectives are then assessed by the EU's technical committee (STECF 2016).

Administrative effect

The expected administrative effect is that a delegated act from the EU will lead to Swedish regulations such as the introduction of additional fishing regulations including no-fishing zones. This is also expected to lead to an adjustment of supervision and control of fishing activities in accordance with that agreed in the proposal to the European Commission. SwAM is responsible for fisheries control through electronic logbooks and monitoring of the movement patterns of fishing vessels, including requirements for the use of AIS (Automatic Identification System) for the positioning of the fishing vessels around the regulated areas where appropriate. The Coast Guard can carry out inspections at sea and aerial surveillance based on identified risks.

Changes in behaviour

The expected change in behaviour as a result of new fishing regulations is a change in fishing patterns, where fishing effort is shifted from no-fishing zones to nearby fishing areas. Compliance and change in fishing patterns can be evaluated through control and spatial data generated by the requirement of AIS for positioning of fishing vessels. In the areas where fishing with certain gears is still allowed, enforcement and fishing controls can be an important part of the evaluation. Enforcement should be documented so that the number of infringements can be related to the number of fisheries inspections.

One clear expected side effect is a shift in fishing effort to other surrounding areas. Such changes in fishing patterns and expected negative effects have been modelled, but it may be more reasonable to follow the changes in fishing patterns after the closure. It is also possible to monitor changes in catch per effort for the fishing fleet to provide an indication of changes in fishing conditions.

Regular evaluation of compliance in relation to gear use and closed areas is desirable based on the monitoring that takes place. In this context, the movement of fishing effort and the change in catches in these fished areas can also be evaluated.

Environmental effect

The environmental effects of the measures will partly be assessed through existing monitoring programmes. In the selected example of Bratten, the environmental effects of the fisheries regulations are evaluated more specifically through the monitoring of benthic animals on soft bottoms sensitive to trawling, in protected areas compared with areas that remain trawled. In environments with protected reefs, there is also an evaluation of changes in the occurrence of species considered as sensitive to sedimentation caused by trawling (Swedish University of Agricultural Sciences 2019). The design of the evaluation should, if possible, include data collection before the fishing regulation is introduced and in comparable habitats that continue to be fished (known as BACI design).

4.4.6. Regulation: ÅPH 34, Strengthened enforcement and improved regulation of recreational fishing gears

Background

The measure was decided as part of the PoM 2022–2027. The aim of the measure is to ensure compliance with the rules in recreational fishing through enhanced inspection and enforcement and to minimise the risk of loss of passive gear, i.e., gear for which the catch operation does not require active movement of the gear. The measure also aims to reduce the input and impact of marine litter and ghost fishing gear from recreational fishing, and to improve the status of fish stocks in the Skagerrak, Kattegat, and the Baltic Sea. The draft implementation plan for the measure is divided into six activities, and the focus of this example is on activities related to regulation and enforcement. Other activities focus on information and reporting, in particular to address littering. SwAM is the responsible authority.

Application of the evaluation model to ÅPH 34

The measure is planned to be implemented through improved labelling/marking of fishing gear, which will also enable a more efficient disposal of lost gear. SwAM will develop and implement a reporting and inspection tool for control of fisheries and produce guidance and information material for the harmonisation and quality assurance of fisheries inspection.


Driftwood and lost fishing net. Photo: Eva Wilcock, Unsplash.

Output

The measure aims to reduce the incidence of lost gear and thus the occurrence of new ghost fishing gear, initially by reviewing the existing regulations on the marking and labelling of gear with a view to modernising the requirements, taking into account developments in the design of fishing gear and the possibility to locate lost gear.

The output is national, i.e., regulations for nationally managed species. Follow-up of the measure should include reviewing and documenting the regulations that have been adopted.

Administrative effect

One administrative effect described for the measure is more effective inspection and enforcement. This in turn is assumed to lead to improved implementation and follow-up of management measures. As an example, SwAM states that the measure can discourage inappropriate design of gear and incorrect use of gear in coastal marine protected areas and conservation areas. Better reporting and follow-up of inspections are also expected to enable a more risk-based approach which could lead to more efficient use of resources. This is intended to facilitate coordination between authorities, harmonise fisheries control between authorities, make the use of resources more efficient and increase legal certainty.

The administrative effect “more effective supervision” could be evaluated both through the new operational reporting system which generates data, and through a more qualitative analysis of supervisory guidance documents combined with interviews with officials to evaluate whether the new regulations and reporting system are working as intended.

Changes in behaviour

Increased compliance by recreational fishermen is expected to discourage inappropriate design and use of gear in coastal marine protected areas and fisheries closures. Improved compliance is in turn assumed to reduce the impact on fish stocks.

The implementation plan proposes to measure compliance based on the detailed reporting which is an activity and a tool to be developed as part of the implementation of the measure. This appears to be a reasonable method to evaluate compliance.

Environmental effect

Monitoring of marine litter should make it possible to link effects to the measure over time, provided that the monitoring is appropriately designed and carried out to a sufficient extent, which can be challenging in the marine environment.

It appears difficult to isolate the effect of the proposed measure on fishing mortality, as this is influenced by several interacting factors. Instead, the evaluation of this effect is based on the assumption that the measures in ÅPH 34 will result in a reduction in fishing mortality. This means that the evaluation of administrative effects and change in behaviour will guide the estimation of environmental effects that may result from the measure.

4.4.7. Regulation: ÅPH 35, Promote a sustainable size distribution of coastal fish communities to retain important ecological functions in the food web

Background

The aim of ÅPH 35 is to promote a natural size and age distribution of species affected by fisheries in coastal fish communities. This in turn will ensure that the functions of these species in the food web are maintained. While this measure primarily addresses the problem that large, mature individuals of many fish species have declined in number, potentially impairing the reproduction of many species, the measure also opens the possibility of protecting individuals in other size classes (e.g., particularly small individuals) if this can contribute to achieving the overall objective of the measure.

ÅPH 35 was introduced in the PoM 2022–2027. A draft implementation plan was available for the current project, which mentions one activity: “introduce size-related management measures”. SwAM is the responsible authority and is expected to work adaptively with continuous updates of these size-related management measures, which can if necessary be different in different parts of the country to take into account regional differences.

Perch, *Perca fluviatilis*. Photo: Mikael Crawford, Yle

Application of the evaluation model to ÅPH 35

The implementation plan for the measure describes both the overall activities on the part of the responsible authority and the desired outcome in the form of environmental effects. The work will be carried out by SwAM and have environmental effects through changes in the behaviour of commercial and recreational fisheries.

Output

The main output is the regular updating of size-based regulations in fisheries in different parts of the country. Management measures may also include protected areas and fishing bans during certain periods, insofar as this is expected to contribute to achieving the desired size distributions of the species concerned, as well as regulations on the authorised dimensions of fishing gear. Follow-up could be done by tracking whether these size-related management measures are updated when new information on the size distributions of fish stocks becomes available. Information on the size distributions of fish stocks is updated annually and a follow-up could in principle also be carried out annually.

Administrative effect

The main administrative effect of the measure is precisely that regulations on size and age classes of different species will be continuously updated as new information becomes available. The implementation plan does not list administrative effects separately, which can be interpreted as taking them for granted. In practice, the administrative effects can be monitored and evaluated in parallel with the output, with the addition that the relationship between new information on size and age distribution and new regulations on the size classes allowed to be fished could be statistically analysed.

Changes in behaviour

The main behavioural change expected from the measure is a reduction in fishing pressure on the size and age classes that are considered important for the long-term viability of the species concerned. Behavioural changes can be evaluated by examining whether the fishing pressure on different size and age classes actually changes when the regulations are updated, and in particular whether the fishing pressure actually decreases for size and age classes that are given increased protection (or where fishing is stopped altogether). Such an analysis may also reveal possible side effects in the form of increased fishing pressure on other size and age classes or on other species.

Environmental effect

The main environmental effect listed in the implementation plan for the measure is "reduction of unwanted fishing mortality of coastal species targeted by the measure", which will be followed up through environmental monitoring. However, the aim of the measure is not to reduce unwanted fishing mortality in general, but rather that the changes in regulations should lead to a size distribution of species affected by fisheries that resembles the natural distribution. Given that this is the objective of the measure, an evaluation of the environmental effect would need to include estimating the natural size distributions of different stocks, where such estimates do not already exist, as well as evaluating whether the size distributions of the different stocks are moving towards or away from these natural distributions. At the same time, other processes, such as climate change, will also affect the size and age distributions of different species. It will therefore often be difficult to separate the effects of this measure from the effects of other processes. In practice, a follow-up of how size distributions in different stocks develop should therefore be easier to carry out than an evaluation of the extent to which this particular measure has contributed to that development.

The Swedish national impact assessment for the PoM (2022–2027)[12] has attempted to estimate the economic effects of this measure. However, the estimate focused on the short-term economic costs resulting from the reduced value added in commercial fishing and reduced consumer surplus in recreational fishing. Apart from the fact that it is questionable to compare value added with consumer surplus as indicators (see, e.g., Blomquist et al. 2022), this means that the long-term, hopefully positive, effects of the measure on future fishing opportunities are not addressed.

4.5. COMMENTARY

By applying the proposed evaluation model to the measures in the Swedish PoM, we show that for most types of measures it is possible to evaluate all the steps in the model. However, the further along the effect chain the evaluation takes place, the more difficult it is to link measured changes to individual measures. It is particularly difficult to attribute changes in the state of the environment and pressures to individual measures, as there are

[12] https://www.havochvatten.se/download/18.1b25360d17e614471a0173c9/1642436313946/rapport-2021-20-miljokonsekvensbeskrivning.pdf (in Swedish)

several interacting measures for all the thematic areas, both within the PoM for the marine environment and measures implemented, for example, in the programme of measures established under the EU Water Framework Directive (2000/60/EC). Opportunities to detect environmental effects of measures through environmental monitoring do exist, for example, when bans on anthropogenic substances such as plastic items or specific chemicals are introduced. It should eventually be possible to detect such measures in the monitoring of beach litter and hazardous substances. In most cases, however, dedicated monitoring programmes need to be designed to evaluate the environmental effects of individual measures. In some cases, effects can also be estimated with the support of models and templates, such as nutrient load reductions. However, for most of the measures in the PoM it is important to evaluate results early in the effect chain. For example, a prerequisite for awareness-raising measures to have an effect is that they reach the intended target group. If not, the expected behavioural changes or environmental effects of the measure will not be realised. Several measures in the Swedish PoM are also preventive, such as guidance documents for marine spatial planning. As the effect of preventive measures cannot be assessed by measuring changes in the state of the environment, the evaluation of administrative effects and of behavioural changes need to form the basis for assessing the effects of such measures.

As can be seen from the examples, a mix of methods is often appropriate for evaluation of effects, which can include both qualitative and quantitative methods. The choice of methods will depend, among other things, on which step in the effect chain is being evaluated, what the evaluation question is, how or whether evaluations have been carried out previously, and available resources. The availability of data may also influence the choice of method.

5 RECOMMENDATIONS

In many cases, it is not possible to clearly link changes in management, behaviour, or the environment to individual measures. This is particularly the case for environmental effects, as the impact of several measures and management processes influence the outcome, as do anthropogenic and natural changes in the ecosystem. However, an approach to evaluating individual measures is still necessary to enable measures to be adjusted and optimised and to achieve efficient use of resources for their implementation.

To structure the follow-up and evaluation of measures, we recommend that the framework and the extended model presented in this report is applied for evaluating measures in the Swedish PoM for the marine environment. The model, which is based on the relationship between output of activities in the administration, administrative effects, behavioural changes, and environmental effects in an effect chain, facilitates a more systematic and consistent evaluation of measures. The examples of evaluation of measures in the PoM show different possibilities and methods for evaluating different types of measures and steps in the model. However, we would like to emphasise that the exact parameters, data requirements and choice of methods are matters to be specified by future evaluators.

One of our conclusions is that many types of measures benefit from being evaluated at an early step in the effect chain. This is to be able to adjust measures as early as possible if they do not meet the assumptions made when the causal effect chain was formulated, or where, for example, unforeseen changes in behaviour prevent expected environmental effects or lead to negative side effects.

Evaluating the effect of measures requires internal capacity within the administration or the use of external evaluators and consequently the allocation of resources. However, a structured evaluation that enables an adaptive approach can provide both economic and environmental benefits in the long term, as resources for actual measures can be used more efficiently. Another benefit of a structured evaluation approach is that the work on measures becomes more transparent.

It should also be noted that, in many cases, the evaluation of the effects of individual measures requires the collection of new specific data. This can be done, for example, through surveys and interviews with the target groups for the measure or through the design of monitoring programmes to evaluate specific aspects of a measure. In many cases, data and information will also need to be collected before the measures are implemented. It is therefore recommended that a broader approach is taken when formulating the measures to clarify what data and types of methods may be appropriate for future evaluations.

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APPENDICES

APPENDIX 1 CATEGORISATION OF MEASURE TYPES PER MEASURE

The list shows the categorisation of measure types per measure made in the project and that is illustrated in Figure 5. The colour markings for the various measures illustrate the thematic area that the measures fall within according to the Swedish Agency for Marine and Water Management's classification.

Thematic areas:

- Biodiversity
- Hazardous substances
- Fish and shellfish affected by fishing
- Invasive species
- Hydrographic conditions
- Marine food webs
- Marine protected areas
- Marine litter
- Restoration
- Underwater noise
- Follow-up
- Eutrophication

MEASURE		TYPE OF MEASURE
ÅPH 1	Design a pilot project to develop methods for control and local combating of invasive non-indigenous species.	Method development
ÅPH 2	Develop technical tools to improve the availability and quality of information on alien species. *Deleted from the 2022-2027 PoM.*	Digital tool Awareness raising
ÅPH 3	Develop a national warning and response system for early detection of new invasive alien species, together with handling and emergency plans for these species.	Method development
ÅPH 4	Introduce new fishing regulations to protect particularly endangered coastal spawning stocks within the trawling limit in the Skagerrak, Kattegat and Baltic Sea.	Regulation
ÅPH 5	Introduce new fishing rules aimed at more species-selective fishing within the trawling limit in the Skagerrak, Kattegat and Baltic Sea.	Regulation
ÅPH 6	Introduce fishing rules aimed at reducing fishing pressure on coastal stocks, which need enhanced protection but which can be fished to some extent, within the trawling limit in the Skagerrak, Kattegat and Baltic Sea.	Regulation
ÅPH 7	Investigate where additional protected areas for fish should be established in coastal areas, and establish such areas.	Regulation

ÅPH 8	Investigate for which species and during which time of year general fishing closures should be introduced for coastal fish, and establish such areas.	**Regulation**
ÅPH 9	Adjust fleet capacity in line with fishing opportunities/Adapt the capacity of the fishing fleet to the available fishing opportunities in certain fleet segments.	**Regulation**
ÅPH 10	Investigate the possibility of influencing the internal nutrient load locally in eutrophic bays, as well as in the Baltic Sea/Measures against the internal load of phosphorus in the Baltic Sea.	**Technical guidance**
ÅPH 11	Examine the possibility of financially compensating net removals of nitrogen and phosphorus from the aquatic environment through the cultivation and harvesting of blue catch crops where possible in marine areas that do not achieve good environmental status, as well as to stimulate techniques for the cultivation and processing of blue catch crops.	**Economic instrument**
ÅPH 12	Stimulate aquaculture techniques, which provides no net load in marine areas not achieving good environmental status.	**Economic instrument** **Awareness raising**
ÅPH 13	Develop a guidance on how changes in hydrographic conditions affect biodiversity and ecosystems.	**Method development** **Technical guidance**
ÅPH 14	Follow up and develop support and guidance for municipal marine and coastal planning in accordance with the Planning and Building Act.	**Knowledge building** **Technical guidance**
ÅPH 15	Develop guidance aimed at authorities and commercial operations for the disposal of contaminants and fouling in the cleaning of ship hulls.	**Technical guidance** **Supervisory guidance**
ÅPH 16	Improved management of contaminated sediments.	**Economic instrument** **Knowledge building** **Method development**
ÅPH 17	Reducing the spread of dangerous substances from recreational vessels/ Reduce the spread of contaminants from recreational vessels.	**Regulation** **Technical Guidance** **Supervisory guidance**
ÅPH 18	To identify the substances that may be present in effluent water from waste water treatment plants in concentrations likely to have a negative impact on the marine environment. In addition, with regard to the identified risks, examine the need for and on the basis of such needs develop general emission requirements/indicative benchmarks, applicable control/measurement methods and guidance for supervision and review. *Deleted from the 2022–2027 PoM.*	**Regulation** **Supervisory guidance** **Method development**

ÅPH 19	Promote the efficient and sustainable collection and reception of lost fishing gear and prevent further losses of fishing gear to the marine environment.	**Economic instrument** **Awareness raising** **Technical guidance**
ÅPH 20	Develop a targeted national information campaign to the public and consumers on common types of litter in the marine environment, its negative impact on the environment and the link to consumer behavior.	**Awareness raising**
ÅPH 21	Support initiatives that promote, organise and implement beach cleaning in particularly affected areas.	**Digital tool** **Economic instrument** **Awareness raising**
ÅPH 22	Conduct strategic work through the inclusion of marine litter in relevant waste management plans and programmes, including municipal waste plans, highlighting the significance of waste management in the generation of marine litter. Priority needs to be given to plastic material streams and instruments need to be investigated in order to reduce the occurrence of plastic objects as litter in the marine environment.	**Economic instrument** **Regulation** **Technical guidance**
ÅPH 23	When revising municipal waste plans, identify and highlight how waste management can help reduce the occurrence of marine litter and set targets for such work.	**Knowledge building** **Technical guidance**
ÅPH 24	Develop a comprehensive framework for national action plans for marine endangered species and to coordinate work nationally.	**Programme of measures**
ÅPH 25	Develop a programme for knowledge building about marine endangered species and habitats and to coordinate the work nationally.	**Knowledge building**
ÅPH 26	Develop guidance on the content in management documents for marine protected areas.	**Technical guidance**
ÅPH 27	Establish new marine protected areas and other area-based conservation measures to a sufficient extent to support achievement of good environmental status.	**Regulation**
ÅPH 28	Introduce management measures in marine protected areas (existing/new, where they do not exist today).	**Regulation**
ÅPH 29	Develop, in consultation with stakeholders, a coordinated strategy of measures to address physical impacts and biological restoration in the coastal water environment.	**Knowledge** **Technical guidance** **Programme of measures**
ÅPH 30	Develop methods for ecological compensation and restoration in the marine environment, with the assistance of the County Administrative Boards.	**Method development** **Technical guidance**

ÅPH 31	In collaboration with the Swedish Agency for Marine and Water Management and the municipalities concerned, to carry out restoration measures for eel grass in the Skagerrak and Kattegat.	**Physical measure** **Knowledge building**
ÅPH 32	Authorities and municipalities working on the MSFD Programme of Measures need to report on the measures implemented.	**Reporting**
ÅPH 33	Guidelines for recognising and managing the risk of invasive non-indigenous species in decisions/management plans/conservation plans for marine protected areas.	**Technical guidance**
ÅPH 34	Strengthened enforcement and improved regulation of recreational fishing gears.	**Digital tool** **Awareness raising** **Regulation** **Supervisory guidance**
ÅPH 35	Promote a sustainable size distribution of coastal fish communities to retain important ecological functions in the food web.	**Regulation**
ÅPH 36	Reduce the trawl swept area, promote the use of selective and low impact gears and compile a summary of trawling impact on coastal fish stocks.	**Knowledge building** **Regulation**
ÅPH 37	Countering the dispersal of contaminants in marine areas with dumped ammunition and chemical warfare agents.	**Knowledge building** **Regulation** **Technical guidance**
ÅPH 38	Minimise the environmental impact from shipping in the marine environment.	**Economic instrument** **Knowledge building** **Awareness raising** **Regulation**
ÅPH 39	Expert support for oil pollution protection.	**Economic instrument** **Method development**
ÅPH 40	Reduce the use of biocide containing anti-fouling paints on leisure boats.	**Method development** **Regulation** **Technical guidance** **Supervisory guidance**
ÅPH 41	Active phase-out of two-stroke engines with carburettors on leisure boats.	**Economic instrument** **Awareness raising** **Regulation**
ÅPH 42	Product, material and marking developments regarding fishing gear.	**Method development** **Technical guidance**

ÅPH 43	Guidelines for minimising the risk of adverse effects to marine mammals from seismic surveys.	**Technical guidance**
ÅPH 44	Develop guidance for the implementation of ecosystem based marine management at sea basin level.	**Method development** **Technical guidance**
ÅPH 45	Establishment of management councils for protected areas and other spatial management measures in Swedish marine areas.	**Method development**
ÅPH 46	Needs based, area-specific predator control; grey seal in the Baltic Sea, harbour seal in the North Sea and cormorant, to support measures to restore local, coastal fish communities.	**Physical measure** **Regulation**

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