Review of pilot studies under EU-MAP 2017-2019 (2020-2021): Environmental data for aquaculture

Report

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1. Introduction

1.1. Environmental data for aquaculture

Aquaculture has surpassed the captured based fisheries in terms of food provision at a global level. However, the increasing intensification of the aquaculture production has raised concern of the sectors long-term sustainability especially with regards to issues related to emissions of nutrients and organic material (Naylor et al. 2021; Nielsen 2012), use of medicine and antibiotics (Lulijwa et al. 2020), feed components (Naylor et al. 2000) and animal welfare (Muniesa et al. 2020).

Lack of data on the environmental effect originating from aquaculture production significantly reduce the opportunity for analyzing effects and giving correct advice on aquaculture management to aquaculture farmers and policy makers across Europe.

Therefore, environmental data for aquaculture is an important component of the EU Data Collection Framework[1] (DFC). However, these data have not been collected and evaluated in a coherent context before. Thus, in the framework of the EU-MAP[2], Member States (MS) were given the opportunity to carry out pilot studies to investigate the best way to collect data on the identified variables assessing the amount of medicine used and the mortality within the EU aquaculture industry.

Under the legal framework (EU, 2016), MS were asked to collect environmental data on marine aquaculture, and optionally on freshwater aquaculture, to enable the assessment of the performance of the European Union aquaculture sector. Environmental data may be collected on the basis of pilot studies (PS) and extrapolated to indicate totals relevant to the total volume of fish produced in the MS. The environmental data shall be collected every two years containing medicine by type in grams and mortality in percentages for the total production.

1.2. Terms of Reference

EU Member States reported pilot studies by 15 March 2021. These pilot studies were evaluated by two experts according to the following Terms of References (ToRs):

ToR 1: Review of the supporting reports and documents on pilot studies provided by the Member States.

ToR 2: Drafting of a single and harmonised document containing an evaluation of pilot studies by Member State, and a comprehensive summary of the main features and outcomes of the pilot studies, including but not only: a) methodologies and why they succeeded (or not); b) difficulties encountered (and how to avoid and/or solve them); c) conclusions and d) propose a common format to provide data related to table 8 (Commission implementing decision (EU) 2016/1251).

[1] Regulation (EU) 2017/1004 of the European Parliament and of the Council of 17 May 2017 on the establishment of a Union framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy and repealing Council Regulation (EC) No 199/2008 (recast). ELI: http://data.europa.eu/eli/reg/2017/1004/2021-07-14

[2] COMMISSION IMPLEMENTING DECISION (EU) 2016/1251 of 12 July 2016 adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017-2019. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1585328126380&uri=CELEX:32016D1251

2. Summary of the evaluation of the pilot studies

2.1. Main achievements

In general, most MS concludes from the PS that the data on mortality and medicine use can be collected (in some form, related to Table 8).

- Denmark, Finland, Slovenia and Sweden have identified databases and registers in which the requested variables are already available, which have allowed the inclusion of these variables in regular sampling if requested.
- The rest of the countries have designed and tested data collection procedures (questionnaires), which allows for an inclusion of these variables in regular sampling.
- One country abstained from doing the PS do to the lack of clear definitions of the variables.

2.2. Main difficulties encountered

The main difficulties encountered is the lack of definitions for the variables to be collected. When asking for data it should have a clear purpose. What question can be answered if these data are available, at which level of detail and in what quality?

MS express doubts and uncertainties about the definition of the variables and how to interpret, measure and collect these variables

Mortality:

- Should data be collected in kilograms or in numbers of dead fish?
- Should data be collected by species?
- Should data be collected by production technology?
- Should data be related to what caused the mortality (diseases, predation and others)
- At which stage of the production should the numbers be provided (hatcheries or grow-out).
- What should be collected for extensive production environment, such as, sea based mussel and oyster farming? Or extensive carp farming?

Medicine:

- Should data be collected in grams for the “active ingredient” or by total weight of the prescript medicine or feed containing the medicine?
- Should data be collected by species?
- Should data be collected by production technology?

Data collection issues:

- It can be very difficult to obtain the data, especially on medicine use, from the companies. It can be very time consuming for private farmers/enterprises to gather and report the data and they are not used to report this kind of data, even though, they have the prescription from the veterinarians and a general knowledge on the mortality encountered.
- It can be very difficult to extrapolate results from a sample to the whole population. This requires a very detailed and extensive survey plan covering all species and production techniques.

2.3. Recommendations

1. Clear purpose of the data collection

There should be a clear purpose of why data should be collected. The purpose should be clearly stated so private producers will know what it is used for when they deliver data to public authorities and end-users. If the end-users cannot justify why the data should be collected, it should not be collected at all.

2. Use the correct label for the variables

The data on mortality and medicine are not as such "environmental variables", which make it misleading and cloud the purpose of why they should be collected. Increasing mortality due to diseases is most often a result of an intensification of the production process, which is seen in all domesticated animal productions (pigs, chickens, cows etc.). The use of medicine is closely linked to production method and animal welfare – and not the "environment" per see. Furthermore, the use of medicine (and other chemicals) are also related to human health and food security. Thus, how to put a label on a variable depend on what it is used for (points back at 1).

3. A clear set of definitions should be made by "professionals"

There is no clear definition on what data should be collected on mortality and medicine, which is an obstacle for MS to collect the data, as they do not know what to collect and report. Furthermore, there is the same confusion at the farm/enterprises level when asked for data. Both variables are currently too general. Just as a starting point, it needs to be clarified if this refers to mortality based on numbers (of individuals) or on weight (kg) and regarding "medicine", it is unclear if this refers to grams of the product or of active ingredients, or both. The definitions should be worked out in detail with "professionals" within animal welfare and care, such as biologist and veterinarians. If private and public economic values can be attached to the two variables it is relevant for economist to attend.

4. Data should be divided by species and production technique

Mortality and medicine use are highly dependent on the species produced and the production systems used. If data should be collected it is important that the data can be divided accordingly. The segmentation used for the economic data collection provide a good foundation for the division on species and production technology.

5. Data should be analysed by "professionals"

If variables collected should be analysed properly, experts within the subject of mortality and medicine use should be present (aquaculture producers, biologist, veterinarians etc.). This is not a task for economists unless a connection can be drawn from the mortality and use of medicine to the cost and benefit for the private producer or the positive or negative externalities of using medicine at the society level. As there has been no attempt to link the so called "environmental" data collection with economic values, it is currently difficult to see the purpose of this data collection within an economic report setting.

6. The methodology used should be optional

From the PS and earlier data collection studies and recommendations, the method used for data collection should be optional to the MS. Data collection based on either register data or by questionnaire have proved to be successful and being able to achieve the goals of the data collection.

3. Elaboration on the evaluation process

3.1 Ambiguities of the pilot study objective

Based on the evaluation of the pilot studies, the evaluation reveals that the lack of a precise formulation of the variables to collect have led to different interpretations by the MS of which data to collect and how.

This diversity has also led to a variety of reported results, which were not always in line with the originally intention of the pilot studies. Thus, it has not in all cases been easy to assess if the main objective of the pilot study was in line with the original intention of the data collection on mortality and medicine use.

Some MS have focused on a few species were others have included the whole sector. In other cases, the pilot studies were used to develop methodologies and test the availability of data from public registers, existing data collections or at farm level. Thus, in some cases, the data was not collected or the collected data was deficient.

3.2 Species coverage

Lessons learned:

In general, the variables “medicine” and “mortality” should be reported by species.

Medicine: There are significant differences in the medicine (substances) used for different species. Furthermore, for some species (mussels and oysters) medicine is not used at all. In more controlled environments for species such as finfish, the opportunity for treating diseases is better and the use and consumption of medicine is therefor higher.

Mortality: The same is the case for mortality. In controlled environments it is much easier to assess the mortality (and the causes) than in open environments with less control over the production process.

3.3 Production system

Lessons learned:

In general, the variables “medicine” and “mortality” should be reported by production system or technique.

Medicine: The use of medicines is closely related to the type of production system or technique used do to the fact that production system that offers higher control over the production process (closed or semi-closed system) also has the ability to control that the medicine is applied in the right amounts and have an effect. On the other hand, closed or semi-closed system are often more prone to diseases do to a higher population density in the production systems. Furthermore, in open production systems like for mussels and oysters medicine is not used at all.

Mortality: The same is the case for mortality. In closed or semi-closed production systems it is much easier to assess the mortality (and the causes) than in open systems with less control over the production process.

3.4 Marine, brackish or freshwater

The use of different production environments in term of the use of marine, brackish or fresh waters most often follows the choice of species produced and production system used and will therefore

automatically be taken into account if the data collection follows a division on species and production system. See above.

3.5 Periodicity

It will be important to collect the variables continuously.

The use of medicine and mortality depend on several factors and a single year of data collection may not be representative for a "normal" situation. Examples of outside coming shock can be temperature fluctuations, Algae blooming, disease outbreaks, storms and flooding.

Furthermore, assessment models often require time series data. If data are not annual, imputations are needed which introduce more uncertainty. Data collection on an annual basis is therefore preferable.

3.6 Overall considerations

A data collection following a division on species and production system will allow comparison between MS and provide an overview at the EU level for different species and production systems. This will also allow for analysing sector specific issues within species and production systems at local regional or the EU level.

In that respect, a MS or EU total for the two variables will not be of any help, if the goal of the data collection is to evaluate "best practice" and give advice on how to achieving good management practices regarding the use of medicine and in order to be able to reducing mortality.

3.7. Propose a common format to provide data related to table 8

(Commission implementing decision (EU) 2016/1251)

The reporting of environmental variables should follow the structure for the economic variables collected. This means that medicine and treatments administered and mortality should be collected by species and production system/technology (see above recommendations).

However, the specification and units of the two variables should be determined by "professionals", in order to collect data that are useful for identifying best practice and provide management advice.

When a proposal is put forward on variable definition a common format for reporting should be made available to MS to secure that the reported variables are comparable across MS, species and production systems.

When defining and specifying variables, the choice of the indicators to measure the variables should consider policy priorities and the detail of information obtained, but also other aspects such as feasibility, data availability, and understandability (by the provider, the collector and the end-user), among others (FAO, 1999, p.20)

4. Review and evaluation of the pilot studies

4.1 Overview

A complete overview of the evaluations of the PS by MS, are available in Annex 1.

4.2 Individual countries

4.2.1. AUSTRIA

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim is to test

- the generation of environmental data for representative trout and carp farms,

- the statistical projection of the representative farms on the corresponding segment level of the overall population, and

- the further methodical development as a basis for a possible sector-specific data collection.

Duration, including if extended during 2020-2021

The implementation period of the pilot study was scheduled for 12 months (April 2020 – March 2021). Due to the Covid-19 pandemic and the necessary measures, the second set of the focus group could not yet be held. Therefore, the Pilot Study was extended until September 2021.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was the Austrian regions that exhibit the highest production for carp (Lower Austria – NUTS: AT 12) and trout (Upper Austria – NUTS: AT 31). The Population was trout and carp farms.

Target species and environment of the study (if available)

Target species was carp and trout in fresh water.

Material and methods

The typical farm approach is used. The typical farm approach represents a data acquisition strategy for key figures and operational indicators of agricultural companies based on so-called model farms. It does not generate empirical, but virtual data for sector-typical model farms. The typical farm approach encompasses data sets and collection strategies for different aquaculture production systems (Lasner et al. 2017).

Expected outcomes and results obtained

Achievement of the original expected outcomes

Pilot Study is still under elaboration. Therefore, no outcomes or recommendations can be reported yet.

Deviations from planned with justification

Pilot Study is still under elaboration. Covid-19 has postponed the data collection based on farm interviews and focus groups.

Difficulties encountered

See above

Lessons learned

Therefore, no outcomes or recommendations can be reported yet.

Inclusion into regular sampling or not with justification

Pilot Study is still under elaboration. Therefore, no outcomes or recommendations can be reported yet.

Review of the data provided (if any)

No data provided (see above)

Background documents included (if any)

N/A

TOR 2: Summary and observations

Summary

Austria has not yet concluded the pilot study. Therefore, no outcomes or recommendations can be reported yet.

Observations

Using the benchmark approach for fish farms it is expected (but cannot be concluded yet) that Austria can provide detailed data at farm level and therefore also divided data on species (carp and trout), production techniques and geographic location for mortality and medicine and treatments.

Austria run four different modules under the aquaculture pilot study. This summary refers only to the 4c

- Pilot Study 4a: Environmental data on aquaculture modules 1, 2 and 3 – finished
- Pilot Study 4b: Environmental data on aquaculture module 4 (Assessing the
- production potential of aquaculture in Austria) - finished
- Pilot Study 4c: Environmental data on aquaculture (Detailed assessment of the production potential of aquaculture in selected regions of Austria) is a follow-up to 4b - ongoing
- Pilot Study 4d: Environmental data on aquaculture is a follow–up of Pilot Study 4a, integrated into 3b due to the same methodological approach - ongoing

Modules 1-3 are available in German, while module 4 – also in German – is available here.

- https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0715.pdf
- https://boku.ac.at/fileadmin/data/H03000/H81000/H81200/_TEMP_/aktuell/aquaNovum_Endbericht_20200324_fin.pdf

4.2.2. DENMARK

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim of the pilot study was to analyse to what extent the existing environmental data collected by the Danish Veterinary and Food Administration could fulfil the requirements of the EU(MAP) for environmental variables for aquaculture.

Statistics Denmark already has data on mortality from the account statistics and the Danish Aquaculture Register administered by the Danish Fishery Agency.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2018. The report does not refer to an extension in 2020-2021.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was Denmark. The Population was all commercially operated Danish fish farms registered in the Danish Aquaculture Register.

Target species and environment of the study (if available)

All species produced in Denmark from commercial fish farms. Denmark mainly produce rainbow trout.

Material and methods

The administrative register data collected by the Danish Veterinary and Food Administration contains medicine data at farm level reported by the veterinarian responsible for prescribing medicine. Reporting medicine prescriptions to the national authority is mandatory and controlled by national legislation.

Expected outcomes and results obtained

Achievement of the original expected outcomes

It was established that the requested variables are available in administrative registers in the Danish Veterinary and Food Administration, and it was possible to merge data with the account statistics.

Deviations from planned with justification

No deviations from the planned aim of the pilot study occurred.

Difficulties encountered

No difficulties encountered in the pilot study.

Lessons learned

Non

Inclusion into regular sampling or not with justification

Data for mortality is a part of the regular sampling. Data on medicine and treatments is also collected yearly in official administrative registers and can be included when necessary.

Review of the data provided (if any)

Data were not submitted in the planned data call from DG MARE in February 2021 because they were not mandatory and no templates for reporting medicine and mortality were available. No examples

are available because data was not processed as it turned out not to be required for the data call from DG MARE in February 2021.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Denmark is able to deliver the required data for mortality and medicine at the farm level.

Denmark uses administrative register data at farm level to provide the environmental data.

Observations

Denmark can provide very detailed data at farm level and therefore also divided data on production techniques and geographic location.

Denmark can also from administrative registers, after some moderation, be able to deliver amount of emission of nitrogen and phosphorus.

4.2.3. FINLAND

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim of the pilot study was to collect, calculate and report the environmental data on Finnish marine and inland aquaculture companies having aquaculture as their main activity as defined in the commission delegated decision of the multiannual Union programme (EU, 2019/910) Table 8.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2018.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was Finland. The Population was Finnish marine and inland aquaculture companies.

Target species and environment of the study (if available)

All species produced.

Material and methods

The collection of data on mortality and medicine used are based on register data. The data are collected in a collaboration between the Ministry of the Environment and the Natural Resource Institute Finland (Luke).

The data collection was in full operation in 2018, and data are collected annually (also in 2020-2021). Data are collected at the enterprise level.

In 2018, the data collection on mortality covers approximately 70 % of the aquaculture companies having an environmental permit in Finland. Therefore, there can be a bias in the reported numbers.

Expected outcomes and results obtained

Achievement of the original expected outcomes

Finland used the pilot study to investigate how a collaboration between the Ministry of the Environment and the Natural Resource Institute Finland (Luke) could be strengthened in such a way that the requested data could be transferred between authorities and in a way that would fulfil the requirement of the regulation. It was established that data can be collected through administrative registers already existing in Finland and a further data collection using questionnaires was not needed.

Deviations from planned with justification

No deviations.

Difficulties encountered

Not all producers are answering all questions, which means that this is not a census survey. Data collected are extrapolated to the whole population. This can create some uncertainty. There are also some concerns related to the quality of the data collected in environmental permit system and database (YLVA). More data checks should be made already in the YLVA database when inserting the data, currently it is difficult to spot errors and typos. It is also difficult to check if the correct unit is used when inserting the data."

Lessons learned

Non

Inclusion into regular sampling or not with justification

Data are now part of an annual data collection.

Review of the data provided (if any)

Data are provided for 2017 and 2018 on mortality in kilo and percentage of total production divided on production system. Data for medicine in kilo of total production divided on production system are also provided.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Finland is able to deliver the required data for mortality and medicine at enterprise level.

Finland uses administrative register data at enterprise level to provide the environmental data.

Observations

Finland can provide very detailed data at enterprise level and have the opportunity to divided data on production techniques and maybe also geographic location.

Finland is also able to deliver amount of feed used and the emission of nitrogen and phosphorus.

If the collection of environmental data will not be a part of the new data collection framework, Finland will not process data for reporting under the EU MAP, however, data will remain part of the Finnish data collection.

4.2.4. FRANCE

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The study is divided in two – one on medicine and treatments and one on mortality.

The aim of the pilot study on medicine and treatments is to verify the feasibility of the companies to provide this information, and the reliability of the answers obtained. The study will also verify the feasibility of responding on the basis of sampling of aquaculture enterprises.

For mortality, the aim of the pilot study was to identify how to approach the subject, the question(s) to be asked, the capacity of the companies to answer, the quality of the data collected.

Duration, including if extended during 2020-2021

Both pilot studies were carried out in the data collection between April and November 2019.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was France.

For medicine and treatments: The Population was only fish farms, both freshwater and marine. Other aquaculture activities do not use any treatment products or medicines. This include both intensive and extensive fish farms (ponds) even though the administration of medicines/treatments is lower in extensive farms than in intensive fish farming.

For mortality: All aquaculture activities are affected by mortalities. Shellfish and crustacean farming companies, Marine and freshwater fish farms, Seaweed, micro-algae and spirulina growing farms.

Target species and environment of the study (if available)

See above.

Material and methods

For medicine and treatments: A census survey on both paper and as an online questionnaire for fish farming. An exhaustive list of medicines and treatment products administered in fish farming has been drawn up. This list has been broken down into 3 types of fish farming activity (freshwater fish farming outside ponds, marine fish farming, fish farming in ponds). In each of the questionnaires, the company is asked to indicate the quantity administered per product.

For mortality: The already existing aquaculture questionnaires have been adjusted to add questions on losses and mortality.

Expected outcomes and results obtained

Achievement of the original expected outcomes

For medicine and treatments: The respondents administer the products according to veterinarians' prescriptions and store the prescriptions. It was very time consuming to let the respondents go through the prescriptions one by one in an attempt to answer the question. The farmer was not able to answer the question on the doses, units and dilution, making it difficult to record the quantities administered. However, the fish farmers know the list of treatment products administered. Quantities are no longer requested. The question only relates to the administration or not of treatment products and medicines. A clarification is requested as to whether the product is administered to the whole livestock population or only to a part of it

For mortality: Mortality is difficult to differentiate from other causes of loss in open maritime environments. It is not easy to define whether a loss is linked to predation, mortality, theft, loss due to bad weather. Thus, the loss was estimated as a percentage of the quantities sold, if collected.

In more closed environment cages and ponds it is easier to monitor loss, however it may still be difficult to distinguish between different types of losses (Natural losses, theft, predation, drought, disease, pollution etc.).

Deviations from planned with justification

The tests of the questionnaire allowed the question to be adapted so that it could be filled in. Quantities are no longer requested. The question only relates to the administration or not of treatment products and medicines.

Difficulties encountered

Quantities are not collected, because farmers cannot answer these questions.

Lessons learned

There is a need for clear definitions of what to be collected. Feedback from stakeholders clearly show that without clear definition the data collected will not be comparable and are not useful to any stakeholders. There might also be some strategic answers (mortality and loss may result in a negative image)

Inclusion into regular sampling or not with justification

For medicine and treatments: There will be no inclusion into regular sampling. If the quantities could have been collected, it would have been interesting to monitor changes in practices on an annual basis.

For mortality:

Shellfish and algae/cyanobacteria culture: the question on losses is now incorporated in the annual questionnaire;

Fish farming ponds: the question on losses and predation is incorporated into the annual questionnaire;

Marine fish farming and freshwater fish farming outside ponds: the experts considered that the data did not fluctuate much from year to year. We planned to ask this question only every 3 years.

Review of the data provided (if any)

For medicine and treatments: Only data on substances used are provided at farm level, not quantities.

For mortality: Data is delivered by species, value and volume and percentage of total sales.

Background documents included (if any)

None

TOR 2: Summary and observations

Summary

France is conducting the survey at farm level, which means that data can be split on species and production systems for both medicine and treatments and mortality.

France can deliver information on the different medicine and treatments used (substances) but not the quantities.

France uses survey (questionnaires) to provide the environmental data at farm level.

Observations

France can provide very detailed data at farm level and therefore also divided data on species, production techniques and geographic location.

4.2.5. GREECE

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

In Greece, mortality and antibiotics data may be recorded at the farm or at company level, but are not collected at national level. Aquaculture farms are required to keep annual logbooks, and data are inspected, but not collected. The aim of the pilot study was to gather these data from a sample of 20% of the total sector companies.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2018-2019.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was Greece. The Population was a subsample (20%) of the total population. In the first step the population was divided into subpopulations (subgroups-strata) based on the relevant characteristics:

a) farm techniques,

b) aquaculture species,

c) location of units (North and South Aegean, Ionian Sea, etc., and using even smaller subgroups such as the division of North Aegean into smaller categories, important subgroups for mussel long line aquaculture, or the division of a river, etc.)

d) connection of the companies which are using fish fry derived from the same hatcheries and nurseries facilities (in Greece almost 50% of fish fry is produced by one large company, which supplies her own units and provides to other companies as well).

Target species and environment of the study (if available)

All species produced. Marine fish cages (sea bass, sea bream and other species) in the different subgroup regions. The Marine long line mussel aquaculture. Freshwater trout aquaculture and other freshwater fish.

Material and methods

For the pilot study the stratified sampling method was used, combined with the non –probability method.

Mortality and antibiotics data were requested from companies representing a sample of 20% of the total sector. These companies adequately represented most of the Greek aquaculture territory and had also demonstrated successful cooperation in previous data collection surveys. The questions on mortality and antibiotics was inserted in the survey questionnaire that was already used for collecting economic data.

Expected outcomes and results obtained

Achievement of the original expected outcomes

The results of the pilot study showed that all companies from every subgroup were reluctant to provide antibiotics data, while 50% of the sample based on production (20% of the sector's largest companies) provided only mortality data. These companies were not reluctant to provide the data, because they were either participating in various research or funding programs, or were in the process of compensation claims, due to mortalities.

The poor results of the pilot study led to:

a) an increase in the sample by including all the major companies of the sector

b) the gathering of relevant information from companies who already publish this kind of data on the web or participate in surveys carried out by universities, institutes and state organizations, or from companies who had already filed reports to national authorities for collecting compensations of damage or loss of production (Non-Probability Survey).

Deviations from planned with justification

Deviations:

1) For the Marine fish aquaculture (Sea bass, sea bream and other species), more than 20% of the largest companies of the sector participated in the pilot study, representing almost 50% of the sector's total production. As a result, the achieved sample rate is relatively high, but the fact that most of the companies participating are using fish fry from the same production facilities and the units are located in the same gulf or nearby areas, prevented the use of these environmental data to extrapolation methods (Table 6).

2) For the Mussel long line aquaculture for the fiscal year 2017, most of the units that participated in the pilot study are based in 2 different regions of north Aegean (production from these regions amounts to over 60% of the total production). Due the fact that the units are located 10-13 km from one to another (in the same water flows etc.), the data cannot be used safely with extrapolation methods, since they represent a specific geographical area with specific environmental characteristics. For the fiscal year 2018, environmental data from units from a third region were added (a region that ranks third in terms of production) and the results show significant differences compared to 2018 (Table 7).

3) For the fiscal year 2017 there was no distinction between sea bass- sea bream data and other marine fish data. The companies were reluctant to provide detailed analysis. For the fiscal year 2018, reports from national authorities (filed for compensation reasons) were used for cross-checking with the questionnaires and showed that the category "other marine fish" had higher mortality rates (specifically the red sea bream, Pagrus major).

Difficulties encountered

It may be difficult to use the survey to extrapolate to the whole population if the enterprises entering the survey are not representative for enterprise not surveyed.

Lessons learned

None.

Inclusion into regular sampling or not with justification

Based on the results of the pilot study, only mortality data can be incorporated into regular sampling (PGECON 2019), since they were the only type of data collected during the pilot study. Furthermore, the mortality data were classified as follows:

a) diseases,

b) weather conditions,

c) air and sea predators

d) natural causes - mortalities.

As for the aquaculture medicines data, it is assessed that can only be collected directly from national authorities responsible for the monitoring of aquaculture medicines' application and usage.

For the 2-year duration of the new environmental study, NWP 2020-2021, a 4th topic regarding the mortality and antibiotics data was inserted in the previously used questionnaire and will be sent to all companies in the sector.

Review of the data provided (if any)

Only data on mortality was provided. The data is divided on species and production technology following the reporting of the economic data.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Greece uses survey data based on questionnaires from a sample of farms, which is extrapolated to the whole population. This might create problems if the sample is not representative.

Data for mortality can be collected at farm level. Data for medicine and treatments seems difficult to collect at farm level and it is suggested that this data collection is collected directly from national authorities responsible for the monitoring of aquaculture medicines application and usage.

Observations

Greece can provide data at farm level for mortality and may therefore also be able to divided data on production techniques and geographic location.

It is stated that national authorities responsible for the monitoring of aquaculture medicines application and usage may be able to provide this data. However, if this can be divided on species and production techniques is not clear.

4.2.6. HUNGARY

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

Hungary run a pilot study on the influence of bird predators in aquaculture facilities and develop a methodology to estimate economic damaged caused by the great cormorant. This study, although received at the Commission, has not been analysed for this report.

4.2.7. IRELAND

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim of this pilot study was to introduce the collection of medicines or treatments administered and mortality data, collectively grouped as environmental data, to the annual aquaculture survey.

Duration, including if extended during 2020-2021

Data collection began for mortalities in 2016 and in 2018 in the case of collection of medicines or treatments.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was Ireland. The Population was all active aquaculture businesses and all segments were eligible for sampling.

Target species and environment of the study (if available)

The population of application for collection of medicines or treatments is mainly restricted to the non-organic intensive finfish and other land-based production units. In the case of mortalities measurements, precise values for both mussel segments and seabed cultures generally, that rely on wild seed capture or settlement, are impossible to obtain.

Material and methods

For oyster farms the mortality data was collected by questionnaire forms, and the mortality question was added to the census form for the year 2016 onwards.

For the fish farms data was collected directly by a census questionnaire, from year 2018 onwards.

Expected outcomes and results obtained

Achievement of the original expected outcomes

It was established that data can be collected and data are now obtained by questionnaire each year. The results followed expectations. There are solid mortality data direct from the shellfish sectors and some direct and ample raw data that could be used for proxy estimation for finfish mortality if suitable corrective formulae can be found and applied. Collection of medicines or treatments data has been gathered and probably reflects the relatively miniscule amounts required to service the handful of small land based non-Organic units needing and permitted to use such.

Deviations from planned with justification

Deviations to the plan are in direct response to experience over the pilot period and are considered pragmatic adjustments to these. These are mainly a move from indirect data collection to direct method until or unless proxy data can be better applied and / or with more confidence.

Difficulties encountered

Lack of access to other datasets experienced and responded to by direct survey methods subsequently applied.

Lessons learned

Shellfish farmers welcomed mortality data collection. They see the benefits of this. If a benefit can be seen to a particular data request, there is no difficulty gathering this data. The collection of these data from the salmon on-growing sector are much more problematic. Additionally, such data is difficult to protect at company-level as there are few companies involved in any of the finfish segments.

Inclusion into regular sampling or not with justification

Both environmental variable data are pursued by direct census questionnaire from 2019 onward, for all segments. The collection of medicines or treatments is largely irrelevant for the mainly organically certified Irish industry. The collection of these data can be included in surveys but in general it is not completed.

Review of the data provided (if any)

Data are provided at overall level for medicine and treatment in gram and mortality in percentages per year.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Ireland are able to deliver the required data for mortality and medicine at an overall level.

Ireland use a census questionnaire survey to collect data at company/farm level.

Observations

Ireland can provide the data, however, data on medicine and treatments are not that relevant to shellfish farmers and organic farmers.

There might be issues of confidentiality having only a small population of salmon farmers.

4.2.8. ITALY

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The purpose is to evaluate the feasibility of collecting environmental data on aquaculture, as indicated in tab. 8 of EU Decision 1251/2016, to allow the assessment of some closely related aspects between aquaculture practices and environmental implications.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2017.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area surveyed is Italy. The Population was marine fish farming (excluding shellfish and crustaceans).

Target species and environment of the study (if available)

Marine fish species, targeting the same population and using the sampling plan as for economic data.

Material and methods

Environmental data were collected on a sub-sample to obtain indications of the variables, in relation to the total volume of national fish production. The sample to be investigated is the same one chosen for the collection of economic parameters, selected according to the stratified sampling surveys and in compliance with Tab 6.

An additional questionnaire to that of the economic parameters, was prepared and administered to the sampling units, to collect the specific data provided in tab. 8. The medicines and treatments will be divided by type and dosage (gr), while for mortality the data has been reported as a percentage of different batches raised.

Expected outcomes and results obtained

Achievement of the original expected outcomes

It was established that the pilot study verifies the information collection procedures on healthcare at the production companies, and to develop a data collection form to be used for future surveys, highlighting some difficulties in collecting data that will necessarily have to be overcome in the future routine surveys

Deviations from planned with justification

No deviations.

Difficulties encountered

In the collection of the data foreseen in this pilot study some different levels of difficulty emerged, summarized below:

The first refers to the access of data at the sampled companies, which is not always easy and complete, since it is the acquisition of sensitive elements for the company and which need to meet the company staff and/or the veterinarian of reference in the enterprise.

It is not always easy to obtain the complete formulation of the medicinal principles adopted, since they are almost always already included in food as artificial feed. Even in this case it is necessary to

have the composition and dosages that only the company's veterinarian is able to provide in a complete and exhaustive form.

According to the staff involved, it is not easy to correlate the medicinal treatments administered, often based on several active ingredients, with the mortality data of the fish subjected to the different treatments, just as it is difficult to assess any environmental impacts.

Lessons learned

The people engaged in the data collection of environmental variables and doing interviews with farmers should be better prepared on which questions to ask and what information they can expect to achieve when visiting farmers/companies, because the expertise on these issues may not be available at the farm/company level.

Inclusion into regular sampling or not with justification

The case study on environmental aquaculture data made it possible to verify the data collection procedures on healthcare at the production companies, and to develop a data collection form to be used for future surveys, highlighting some difficulties in collecting data that will necessarily have to be overcome in the future routine surveys, developing the following points:

Need for a specific document by the client of the study explaining the purposes of the data collection and authorizing the territorial network to collect data. Direct relationship with the health manager of the company, often external to the company, for the timely collection of data. In-depth information on accessibility and procedures for accessing health data present for aquaculture.

The report state that the pilot study has allowed to verify the information collection procedures and develop data collection form to be used in future surveys. However, it is unclear if Italy has included environmental variables into the regular sampling.

Review of the data provided (if any)

Data is provided for different kind of treatments, but only covering the pilot study not the country level. The mortality is reported under each treatment. It is unclear how the mortality percentages are related to different treatments. It may only refer to treatment of the exact batch that are treated and not to the population as a whole.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Italy is able to deliver the required data for mortality and medicine for marine fish farms. However, more information is needed on how such a data collection should be structured and for what purpose. Furthermore, it seems difficult to get access to data at the company level, even though, they are obliged to keep the data on treatment. Mortality is collected at batch level, which is different from other countries.

Observations

Italy can provide data for the marine fish farms, however, a data collection on fresh water farms was not included. Furthermore, it is not clear if it is only mortality in the treated batches that are collected or mortality in general.

It is not specified what species the marine fish farms covers, but the production in Italy is mainly sea bass and sea bream. Furthermore, it is not stated if it is only the treatment in the sea cage farms or also in hatcheries that are covered. More information on production technique and at which stage the medicine is applied is needed and the same goes for the mortality.

Mortality is collected at batch level, which may make it difficult to make comparisons to other countries/production systems.

4.2.9. MALTA

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim of the pilot study was to collect environmental data for the aquaculture on a census basis.

Duration, including if extended during 2020-2021

The pilot study has not been carried out!

Environmental data on aquaculture, including a clear description of the geographical area of application

NA

Target species and environment of the study (if available)

NA

Material and methods

NA

Expected outcomes and results obtained

Achievement of the original expected outcomes

The pilot study was not initiated do to missing definitions of the variables to collect.

Deviations from planned with justification

See above.

Difficulties encountered

Missing definitions of the variables to collect, as well as the methodology for such data collection.

Lessons learned

NA

Inclusion into regular sampling or not with justification

Data were not collected.

Review of the data provided (if any)

No data provided (see above)

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Malta did not deliver a pilot study for collecting data on mortality and medicine, but a text explaining the reasons why the pilot study was not initiated.

PGECON recommended that the purpose of the data collection should be clarified and decision to leave or delete Table 8 (Environmental variables for the aquaculture sector) from the new EU DC-MAP should be discussed. In case of the continuation of the aquaculture data collection, the clear legal base

and definitions for the variables "Medicines or treatment administered (by type in gram)" and "Mortalities (in %)" should be provided as well as the methodology for such data collection.

Overall, the PGECON's recommendation was that the purpose of data collection as well as, a clear definition of the required variables should be provided to the Member States before they carry out the pilot study.

As these clarifications and definitions were not provided by DG-MARE, Malta never initiated, carried out or completed this pilot study.

Observations

Missing definitions of the variables to collect was the main reason for not initiating a pilot study.

4.2.10. ROMANIA

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

To analyse the environmental data for aquaculture, regarding the type and quantity of medicines or treatments administered for diseases prevention and control, from the Romanian aquaculture sector and the mortalities registered in aquaculture units.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2017-2019. The study will be continued also for 2020 – 2021.

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area covers all regions of Romania. The population was the whole freshwater aquaculture sector. Data are collected at farm level.

Target species and environment of the study (if available)

All species produced. Romanian production is mostly Cyprinids and salmonids.

Material and methods

The Pilot study was based on quantitative and qualitative methods. The qualitative method involves the interviews conducted in order to establish the form of questionnaire. The quantitative method is represented by sample determination, distribution and collection of the questionnaires.

Expected outcomes and results obtained

Achievement of the original expected outcomes

It was established that it is possible to collect the data.

Deviations from planned with justification

No deviations.

Difficulties encountered

No difficulties encountered.

Lessons learned

Non

Inclusion into regular sampling or not with justification

Data is from the year 2019 a regular part of the Romanian data collection program and will be collected every second year.

1. Review of the data provided (if any)

Data are provided on preventive and disinfection treatments and actions to prevent diseases. The data is furthermore divided on Cyprinids and salmonids and on different production systems (techniques). For some techniques quantities of medicines are provided in grams, and for some others quantities are provide in grams per area of measure (ha or m2), grams per 24h and some others.

Mortality is only provided as an interval for Cyprinids (0.1-10%) and salmonids (1-42%) and are not divided on production techniques for the species. Explanation for the higher mortality rate in salmonid farms is the higher density of the fish in these production systems.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Romania is able to deliver the required data for mortality and medicine. Romanian data are collected by a questionnaire for a representative sample of the freshwater farms. Romania has developed a data collection system for environmental variables, which now is part of the data collection program.

Observations

Romania can provide the environmental data.

Romania is able to deliver the data divided on production techniques and geographic location for medicine use. Differences between species and production systems in the indicators used to measure medicine use, can generate constraints in data aggregation at the national level. The data on mortality can be divided on species. However, it is more uncertain if the mortality can be divided on production techniques.

4.2.11. SLOVENIA

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim of the pilot study is to establish a methodology for collection of Environmental data on aquaculture, and to transfer this methodology to a regular data collection.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2018.

Environmental data on aquaculture, including a clear description of the geographical area of application

The target population are all aquaculture companies located in Slovenia. So, the geographical area is the territory of Republic of Slovenia.

Target species and environment of the study (if available)

All species produced.

Material and methods

The pilot study was based on quantitative and qualitative methods. Qualitative methods included in-depth interviews. Quantitative methods consisted of questionnaires and statistical analysis. Focus groups was used to establish if data exist with main participants being aquaculture companies and Veterinary Administration of the Republic of Slovenia (VARS).

Expected outcomes and results obtained

Achievement of the original expected outcomes

Through the pilot study all the expected results were achieved.

Deviations from planned with justification

The only deviation from the plan was that data were not reported in data call in 2021 due to confidentiality reasons.

Difficulties encountered

Data confidentiality and the lack of a common database proved to be the main problems.

Lessons learned

One of the outcomes of a pilot study is that it might give advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated. The pilot study also gives an answer of feasibility of the research.

Inclusion into regular sampling or not with justification

In 2018, Slovenia fully implemented the pilot study, planned in the Work Plan and incorporated results of the study into the data collection plan. It was assessed that the data recorded in the veterinary diary were sufficient for the purposes of Environmental data collection.

Review of the data provided (if any)

No data provided due to confidentiality.

Background documents included (if any)

Work Plan for data collection in the fisheries and aquaculture sectors 2020-2021.

TOR 2: Summary and observations

Summary

Slovenia are able to deliver the required data for mortality and medicine, however, do to the small number of aquaculture farms data will remain confidential.

The data are already being collected by aquaculture companies. Producers are obliged to keep veterinary intervention diary in which they entered medicines or treatments and mortalities data.

However, data are not transmitted and collected in one place, e.g. in the national veterinary database. Furthermore, only fish farmers engaged in breeding of gilthead seabream and sea bass was keeping this record, however only one such company exist in Slovenia. Data is not kept for shellfish farmers.

Observations

The pilot study examined ways and means of obtaining the necessary data if the sector will increase in the future.

4.2.12. SWEDEN

TOR 1: Review of the pilot studies

Objectives - Aim of the pilot study

The aim of the pilot study was to explore possibilities to collect environmental data on aquaculture in Sweden by developing the existing data collection on production variables.

Duration, including if extended during 2020-2021

The pilot study was carried out in 2018

Environmental data on aquaculture, including a clear description of the geographical area of application

The geographical area was Sweden. The Population was aquaculture producing enterprises, covering the population as the economic data collection.

Target species and environment of the study (if available)

All species produced.

Material and methods

Treatments and medicine are reported to the Swedish Board of Agriculture yearly and can be collected through official administrative records.

Mortality records are mandatory to keep at farm level (National legislation based on the Animal Welfare Act). According to the legislation records should be kept of number, specie, life stage and weight of deceased fish.

Mortality records at farm level will be collected by Statistics Sweden together with the economic and social data for aquaculture, through questionnaires and official records. The first year for implementation of the new questionnaire was for production year 2018 where farmers reported mortality.

Expected outcomes and results obtained

Achievement of the original expected outcomes

It was established that the environmental data can be collected and reported at farm level on a yearly basis.

Deviations from planned with justification

No deviations.

Difficulties encountered

There is confusion on how to report mortality and what percentage of mortality should be reported. Is the mortality a percentage of the production volume in weight or is it a percentage of the number of individuals. Most enterprises record their deceased fish as weight. Thus, the mortality percentage is a percentage of weight in the questionnaire. However, a clarification is needed.

Lessons learned

None.

Inclusion into regular sampling or not with justification

All variables on environmental data for aquaculture are now integrated into the data collection. Treatments are collected through official records and are collected when needed. Mortality is incorporated into already existing data collection from production year 2018 and onwards. Mortality will be collected yearly as the administrative burden of changing the questionnaire is considered to be higher than the yearly collection.

Review of the data provided (if any)

No data provided.

Background documents included (if any)

None.

TOR 2: Summary and observations

Summary

Sweden is able to deliver the required data for mortality and medicine.

Sweden uses administrative register data and the existing data collection for economic and social data to provide the environmental data.

Observations

Sweden can provide very detailed data at farm level and therefore also divided data on production techniques and geographic location.

Definition on how to report the environmental variable is needed. Particularly, the report expresses the convenience of improve the definition of the mortality indicator and its calculation.

References:

EU 2016. Commission Implementing Decision (EU) 2016/1251 of 12. July 2016 adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017-2019.

Regulation (EU) 2017/1004 of the European Parliament and of the Council of 17 May 2017 on the establishment of a Union framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy and repealing Council Regulation (EC) No 199/2008 (recast). ELI: http://data.europa.eu/eli/reg/2017/1004/2021-07-14.

COMMISSION IMPLEMENTING DECISION (EU) 2016/1251 of 12 July 2016 adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017-2019. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1585328126380&uri=CELEX:32016D1251.

FAO (1999). Indicators for sustainable development of Marine Capture Fisheries. x3307e.pdf (fao.org)

Lasner, T., Brinker, A., Nielsen, R., Rad, F. (2017) Establishing a benchmarking for fish farming – Profitability, productivity and energy efficiency of German, Danish and Turkish rainbow trout grow-out systems. Aquaculture Research, 2017, 48, 3134–3148.

Lulijwa, R., Rupia, E.J., and Alfaro, A.C. (2020) Antibiotic use in aquaculture, policies and regulation, health and environmental risks: a review of the top 15 major producers. Reviews in Aquaculture 12, 640–663.

Muniesa, A., Basurco, B., Aguilera, C., Furones, D., Reverté, C., Sanjuan-Vilaplana, A., ... & Tavornpanich, S. (2020). Mapping the knowledge of the main diseases affecting sea bass and sea bream in Mediterranean. Transboundary and emerging diseases, 67(3), 1089-1100.

Naylor, R. L. et al. Effect of aquaculture on world fish supplies. Nature 405, 1017–1024 (2000)

Naylor, R.L., Hardy, R.W., Buschmann, A.H. et al. A 20-year retrospective review of global aquaculture. Nature 591, 551–563 (2021). https://doi.org/10.1038/s41586-021-03308-6

Nielsen, R. (2012) Introducing individual transferable quotas on nitrogen in Danish fresh water aquaculture: Production and profitability gains. Ecological Economics 75, 83-90.

PGECON 2019 Report, Data Collection Framework - europa.eudatacollection.jrc-ec.europa.eu, Slovenia, 6th -10th May, p. 55.

PGECON 2019 recommendations

(Text page 31 and 32 PGECON report)

After a broad discussion about environmental variables and their usefulness, “medicines (g)” and “mortalities (%)” are the only remaining indicators of environmental sustainability in DCF data collection. Considering, that only 2-3 MS provided data on environmental variables for the last aquaculture data call (September 2018) and there is uncertainty with how to deal with those indicators in the economic report on EU aquaculture the demand for the environmental variables is questioned. A question was raised about political objective behind this collection of these data. It was muted that these data could be used to support EMFF funding to establish a compensation scheme for aquaculture enterprises in case of loss of livestock due to deceases or predation. Some federal states in Austria and Germany have introduced national compensation payments for fish loss caused by predators like otters and cormorants.

Furthermore, there is a lack of a sufficient definition on these variables. Both environmental variables are currently too general, in particular “mortality”. There needs to be clarity if this refers to mortality based on numbers (of individuals) or on weight (kg). Regarding “medicine”, it is unclear if this refers to grams of the product or of active ingredients, or both. This in fact hinders MS collecting data at enterprises, as it is simply unclear to them what to collect and report. Furthermore, a sound proposal on how to measure medicine is needed (e.g. veterinary data or scientific studies due to possible concerns of misreporting by enterprises). The collection of medicines is a sensitive topic and if enterprises lose their trust in data collators they will most likely not report anything in the future.

If “mortality” is kept as a variable, a clear definition is needed, as well as further segregation between different causes of mortality to efficiently target fish loss. The potential response rate in case of mortality data might be sufficient, because the question meets the interest of fish farmers. For example, in Greece, where five different mortality categories are established, the response rate is quite high. On the other hand, the perspectives of the farmers are strongly biased (e.g. loss due to predators vs. mismanagement) and its reliability is doubted. To avoid misreporting, a sound methodology regarding the use of non-enterprise data should be worked out and be applied, e.g. scientific studies. On the other side, the effort coming along with scientific studies to measure the exact impact of predators on mortality and a calculation of objective compensation payments might be inappropriately high compared to more a practical (but unscientific) compensation payment system, which bases on affirmations. Drought was also mentioned as a growing cause of mortality.

The discussion shows the need for more work with experts on the topics. If DG MARE as the end-user identifies a reasonable demand for data collection of “medicines” and “mortalities”, PGECON recommends organising a sub-group on that issue. The sub-group should clarify, inter alia, which environmental data is already available due to other regulations (e.g. 2006/88/EG down laying rules on hygienics and health protection for aquaculture) in the MS. This proposal has already been made in PGECON report 2017, but there has not been any progress. The clearing of the underlying reasons for collecting and afterwards the establishment of a subgroup or a workshop to work on the questions is a very important task before the data call in 2020 (in case environmental data are part of the data call). There is the need for participation by DG MARE and STECF, and to have a contact person on these issues.

If the end-user is undecided regarding the usefulness of the environmental variables, even after evaluation of the pilot studies (e.g. from DEU, GBR, MLT, AUT), PGECON recommends deleting the variables “mortality” and “medicine” from future data collection.

However, data on the number of recirculating aquaculture systems, extensive operating aquaculture farms (species: carp; fish farming technique: ponds) and organic aquaculture is already collected under EU Regulation Nr. 762/2008 and Nr. 834/2007 in all MS and provided to Eurostat. In particular, the last two can be seen as undisputed providers of ecosystem services according to scientific literature. Their share in the total production might be a meaningful indicator for environmental sustainability.

Environmental indicators and their data collection (page 35 PGECON report)

• PGECON recommends asking DG MARE, if there is still a need for the variables “medicines (g)” and “mortalities (%)” and to explain the end users’ needs if any.

• If there is no sufficient justification regarding the usefulness of the environmental variables, PGECON recommends deleting the variables “mortality” and “medicine” from future data collection.

• In case the end-users provide sound justification to retain environmental variables, PGECON recommends the establishment of a sub-group, to clarify which environmental data is already available due to other regulations (e.g. 2006/88/EG discuss the definitions) as well as to clarify the definitions of the two environmental variables before the aquaculture data call in 2020. Further, the cause of mortality should be included and analysed (predators, flood, disease, natural etc.), and best practice of data collection is to be worked out (survey, veterinary data, scientific study).

6.18 PGECON recommendation on environmental data for aquaculture: the purpose of the data collection should be clarified by the Commission and decision to keep or delete Table 8 Environmental variables for the aquaculture sector from the new EU-MAP should be discussed.

Country	Aim of the pilot study	Species	Geographical area	Pilot period	Extesion 20-21	Data already available	Data collected from the pilot	Data provided in the pilot	Data collection methodology (Register, sampling…)	Data collection frequency	Mortalities data	Mortalities data description	Mortalities included in regular sampling	Medicines data	Medicine data description
Austria				Still under development											
Denmark	Analyse to what extent the existing environmental data collected by the Danish Veterinary and Food Administration could fulfil the requirements of the EU(MAP) for environmental variables for aquaculture	All species produced (inclued in Danish Aquaculture Register)	Denmark	2018	NO	YES	NO	NO	Register	N/A	YES	N/A	YES	YES	N/A
Finland	Collect, calculate and report the environmental data on Finnish marine and inland aquaculture companies having aquaculture as their main activity	All species produced	Finland	2018	NO	YES	YES	YES	Register	Yearly	YES	Kg	YES	YES	Medicated feed: name of feed, name of medicine, use in kg, medicine concentration g/kg /// Other medicines: name of medicine, type of medicine (Self-mixed medicated feed, other medicines, vaccines, anesthetics), use in concentration g/ml
France	The study is divided in two. The aim of the pilot study on medicine and treatments is to verify the feasibility of the companies to provide this information, and the reliability of the answers obtained. The study will also verify the feasibility of responding on the basis of sampling of aquaculture enterprises. For mortality, the aim of the pilot study was to identify how to approach the subject, the question(s) to be asked, the capacity of the companies to answer, the quality of the data collected.	All species produced	France	2019	NO	NO	YES	YES	Questionaries/Census	N/A	YES	%	YES	YES	Type of substance and number of companies using each of them
Greece	Mortality and antibiotics data may be recorded at the farm or at company level, but are not collected at a national level. Aquaculture farms are required to keep annual logbooks, and data are inspected, but not collected. The aim of the pilot study was to gather these data from a sample of 20% of the total sector companies	All species produced	Greece	2018-2019	NO	NO	YES	YES	Questionaries / Stratified sampling	Yearly	YES	%	YES	NO	NO
Ireland	Introduce the collection of medicines or treatments administered and mortality data, collectively grouped as environmental data, to the annual aquaculture survey at the request the current legal framework.	All species produced	Ireland	From 2016 (mortalities) From 2018 Medicines	NO	NO	YES	YES	Questionaries / Census	Yearly	YES	%	YES	YES	Grams (not specified type of product)

Country	Medicines Included in regular sampling	Inclusion in regular sampling	Main results/outcomes	Comments	Deviations	Difficulties	Solutions	Lessons	PS demands better variable definitions
Austria									
Denmark	YES	YES	Denmark is able to deliver the required data for mortality and medicine at the farm level	It was established that the requested variables are available in administrative registers in the Danish Veterinary and Food Administration, and it was possible to merge data with the account statistics. Reporting medicine prescriptions to the national authority is mandatory and controlled by national legislation. Data for mortality is a part of the regular sampling. Data on medicine and treatments is also collected yearly in official administrative registers and can be included when necessary.	None	None	None	None	NO
Finland	YES	YES	Finland is able to deliver the required data for mortality and medicine at the farm level	All Finnish aquaculture producers are obliged to have a license for aquaculture production and to report the use of fish feed (including the amounts of nitrogen and phosphorus) and medicines as well as fish mortalities to the Finnish environmental management authorities.	None	Some environmental data were available (feed use and mortalities) in other Ministry. Some data were not available (medicines)	Coordination between agencies, lead to the inclusion of the missing variables (medicines) in the environmental data base	As some of the environmental data concerning aquaculture has already been collected by the Ministry of the Environment of Finland, duplication of data collection was avoided, and existing data sources were used	NO
France	NO	YES/NO	For medicines, quantities are no longer requested. The question only relates to the administration or not of treatment products and medicines. For mortalities, mortality is difficult to differentiate from other causes of loss in open maritime environments. It is not easy to define whether a loss is linked to predation, mortality, theft, loss due to bad weather. Thus the loss was estimated as a percentage of the quantities sold, if collected		The tests of the questionnaire allowed the question to be adapted so that it could be filled in. Quantities are no longer requested. The question only relates to the administration or not of treatment products and medicines.	Quantities are not collected, because farmers cannot answer these questions		There is a need for clear definitions of what to be collected. Feedback from stakeholders clearly show that without clear definition the data collected will not be comparable and are not useful to any stakeholders.	YES
Greece	NO	YES	Based on the results of the pilot study, only mortality data can be incorporated into regular sampling (PGECON 2019), since they were the only type of data collected during the pilot study. As for the aquaculture medicines data, it is assessed that can only be collected directly from national authorities responsible for the monitoring of aquaculture medicines' application and usage. For the 2-year duration of the new environmental study, NWP 2020-2021, a 4th topic regarding the mortality and antibiotics data was inserted in the previously used questionnaire and will be sent to all companies in the sector.	Greece uses survey data based on questionnaires from a sample of farms, which is extrapolated to the whole population. This might create problems if the sample is not representative. Data for mortality can be collected at farm level. Data for medicine and treatments seems difficult to collect at farm level.	More than 20% of the largest companies of the sector participated in the pilot study, representing almost 50% of the sector's total production. As a result, the achieved sample rate is relatively high, but the fact that most of the companies participating are using fish fry from the same production facilities and the units are located in the same gulf or nearby areas, prevented the use of these environmental data to extrapolation methods. A similar situation with mussel production.	In 2017, the companies were reluctant to provide detailed analysis. Furthermore, it may be difficult to use the survey to extrapolate to the whole population if the enterprises entering the survey are not representative for enterprise not surveyed	For the fiscal year 2018, reports from national authorities (filed for compensation reasons) were used for cross-checking with the questionnaires and showed that the category "other marine fish" had higher mortality rates. However, this is a temporal solution since compensation is not permanent in time, so this info will not be available for a permanent data collection system		YES
Ireland	YES	YES	It was established that data can be collected and data is now obtained by questionnaire each year. The results followed expectations.	The Irish salmon and much of the mussel segments work to organic certification standards which restricts use of medicines and the shellfish segments are in addition, mainly extensive bivalve mollusc cultures, not requiring any induced chemical or feed inputs. The population of application for collection of medicines or treatments is mainly restricted to the non-organic intensive finfish and other land-based production units. In the case of mortalities measurements, precise values for both mussel segments and seabed cultures generally, that rely on wild seed capture or settlement, are impossible to obtain. There is solid mortality data direct from the shellfish sectors and some direct and ample raw data that could be used for proxy estimation for finfish mortality if suitable corrective formulae can be found and applied. Collection of medicines or treatments data has been gathered and probably reflects the relatively miniscule amounts required to service the handful of small land based non-Organic units needing and permitted to use such.	Mainly a move from indirect data collection to direct method until or unless proxy data can be better applied and / or with more confidence.	Lack of access to other datasets experienced	Direct survey methods subsequently applied	Farmers welcomed mortality data collection if they see the benefits of this. In some segments there can be problems of confidentiality.	NO

Country	Aim of the pilot study	Species	Geographical area	Pilot period	Extesion 20-21	Data already available	Data collected from the pilot	Data provided in the pilot	Data collection methodology (Register, sampling…)	Data collection frequency	Mortalities data	Mortalities data description	Mortalities included in regular sampling	Medicines data	Medicine data description
Italy	Evaluate the feasibility of collecting some environmental data on aquaculture, as indicated in tab. 8 of EU Decision 1251/2016, to allow the assessment of some closely related aspects between aquaculture practices and environmental implications	Marine fish farming species	Italy	2017	NO	NO	YES	YES	Questionaries/ Sampling	N/A	YES	%	?	YES	Type of substance, quantity in g, total or per batch?
Malta	The aim of the pilot study was to collect environmental data for the aquaculture on a census basis.		Malta	NONE	NO	N/A	NO	NO	N/A	N/A	N/A				
Romania	To analyse the environmental data for aquaculture, regarding the type and quantity of medicines or treatments administered for diseases prevention and control, from the Romanian aquaculture sector and the mortalities registered in aquaculture units	All species produced	Romania	2017-2019	YES	NO	YES	YES	Questionaries/ Sampling	Every second year	YES	Percentage in range	YES	YES	Type of substance, quantity in g, purpose
Sweden	Explore possibilities to collect environmental data on aquaculture in Sweden by developing the existing data collection on production variables.	All species produced	Sweden	2018	NO	YES	YES	NO	Register/Questionary	Yearly	YES	%	YES	YES	Substance / grams
Slovenia	Establish a methodology for collection of Environmental data on aquaculture, and to transfer this methodology to a regular data collection	All species produced	Slovenia	2018	NO	YES	NO	NO	Register	N/A	YES	N/A	YES	YES	N/A

Country	Medicines Included in regular sampling	Inclusion in regular sampling	Main results/outcomes	Comments	Deviations	Difficulties	Solutions	Lessons	PS demands better variable definitions
Italy	?	?	The pilot allowed to verify the information collection procedures on healthcare at the production companies , and to develop a data collection form to be used for future surveys , highlighting some difficulties in collecting data that will necessarily have to be overcome in the future routine surveys	In the case of Italy, it looks like they have understood that the variable mortality refers to the mortality in the population that receives the medicines. Furthermore, not clear enough if the amount of gram of medicines correspond to annual total, to a specific batch...	None	Difficulties of the companies to obtain data of medicine formulations and use (quantities used), since medicines usually are in feed.		Better preparation is needed when data should be collected on the environmental variables, because the expertise on these issues may not be available at the farm/company level.	NO
Malta			NONE						YES
Romania	YES	YES	Data is from the year 2019 a regular part of the Romanian data collection program and will be collected every second year		None	None	None	None	NO
Sweden	YES	YES	It was established that the environmental data can be collected and reported at farm level on a yearly basis.			There is a confusion as to what percentage of mortality should be reported. Is the mortality a percentage of the production volume in weight or is it a percentage of the number of individuals. If the size of individual fish is evenly distributed it would not be a big issue, but for enterprises with the whole chain from hatcheries to slaughter it can make a huge difference	Most enterprises record their deceased fish as weight so we interpreted the mortality percentage as percentage of weight in the questionnaire.	Authors of the report feel that it would be good with a clarification and would welcome input on the matter.	YES
Slovenia	YES	YES	Environmental data are already being collected by aquaculture companies. However, data are not transmitted and collected in one place, e.g. in the national veterinary database	If this is true, mortality data in Italy is a total different indicator than in the rest of pilot studies. This can be another example to support the PGCON request about clarifications on variables definitions and methodologies before or at least, at the same time, that the data calls.	Data were not reported in data call due to confidentiality	Data confidentiality and the lack of a common database proved to be the main problems	None	Environmental data are already being collected by aquaculture companies. However, data are not transmitted and collected in one place, e.g. in the national veterinary database	NO