AQUA-LIT

D.3.5 LEARNING LABS OUTCOME (PORTFOLIO OF BEST PRACTICE FACTSHEETS)

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

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AQUA-LIT project

AQUA-LIT is an EASME-EMFF funded project that aims at providing the aquaculture sector with a sustainable toolbox of innovative ideas and methodologies to address the 3 main components of marine littering: prevention & reduction, monitoring & quantification, and removal & recycling.

To fulfil this mission, we will be working face-to-face with aquaculture farmers in three regional Learning Labs: at the Mediterranean basin, the North Sea and the Baltic Sea regions. In parallel, we will identify and cluster existing, upcoming and already implemented tools on marine littering, and we will further develop a platform and an app for providing the 'Tide against marine litter toolbox'.

Lastly, we will 'scale up the tide' by developing the 'policy for less litter' set of recommendations, by showcasing the 'funding a wave of solutions' available for the sector and by coming up with a transferability plan for outermost regions.

Through this, we expect to help all stakeholders from the aquaculture chain to increase the understanding, awareness and availability of solutions, so that a potential transformation of the aquaculture sector towards a less polluting sector can become possible.

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Project Consortium

Geonardo Environmental Technologies (GEO)

European Centre for Information on Marine Science and Technology (EurOcean)

Vlaams Instituut voor de Zee -Flanders Marine Institute- (VLIZ)

Sustainable Projects GmbH (s.Pro)

Instituto Español de Oceanografía -Spanish Institue of Oceanography- (IEO)

Société d'Exploitation du Centre National de la Mer - French National Sea Centre in Boulogne-sur-Mer- (Nausicaá)

Fundo Regional para a Ciência e Tecnologia -Regional Fund for Science and Technology- (FRCT)

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D.3.5 Learning Labs outcome (Portfolio of best practice fact sheets)

1. Summary

Purpose of this document

Marine litter has been recognised as a global concern because it causes harm to marine wildlife, coastal communities, ecosystems and maritime activities, along with negative effects on economies, human health and safety. Among different types of marine pollution, plastics represent the majority of litter in the ocean and 20% of them come from maritime activities.

Aquaculture is the fastest-growing food-producing sector in Europe, with an annual expansion rate of 8% in the last three decades (https://aqua-lit.eu/assets/content/teasers/video/video4.720.mp4]. Moreover, as one of the world's largest producers of fisheries and aquaculture, the European Union aims at boosting the aquaculture sector as part of the blue growth strategy, in order to reduce the pressure on fish stocks exerted by commercial fishing and still meet the increasing demand for sea products in local and international markets.

Just like other industry sectors, the aquaculture faces challenges related to its environmental impact and sustainability. These include constraints of space and good quality water, and measures to protect public health and the environment about which, society and policy makers are very demanding (IUCN, 2009). Consequently, the aquaculture sector is expected to develop and implement preventive measures and innovative solutions to manage non-organic waste, which could become exemplary and lead the way for other sectors.

The purpose of this paper is to assist the offshore aquaculture by providing an inventory (non-exhaustive) of good practice as a means to prevent, reduce, monitor, quantify, remove and recycle marine litter in the Baltic, the Mediterranean and the North Sea basins. It builds on the assumption that adapting and replicating good practice in the management and recovery of aquaculture gear and other equipment, will have a direct impact on the amount of litter that ends up lost or discarded at sea.

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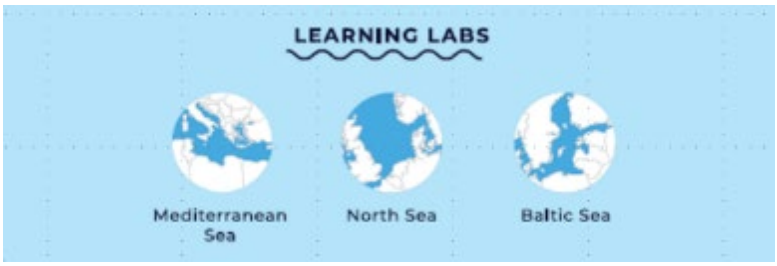
Scope and methods

Throughout the AQUA-LIT project cases of good practice have been identified and collected in collaboration with 120 participants in 4 Learning Labs and 46 interviews carried out in the Baltic, the Mediterranean and the North Sea basins and online from October 2019 to February 2020.



To favour a holistic approach, the participants represented numerous stakeholder categories in the aquaculture value chain (finfish, shellfish and seaweed) and throughout the lifecycle of an aquaculture farm: (1) Initiation, (2) Development, (3) Operations and (4) End of Life as defined by the AQUA-LIT project (Sandra and all, 2019). They were aquaculture farmers, equipment manufacturers, engineering system design and construction companies, academic research groups, representatives of professional clusters and associations, NGOs, local and national policy makers, representatives of certification bodies, waste processing companies and diverse types of communicators.

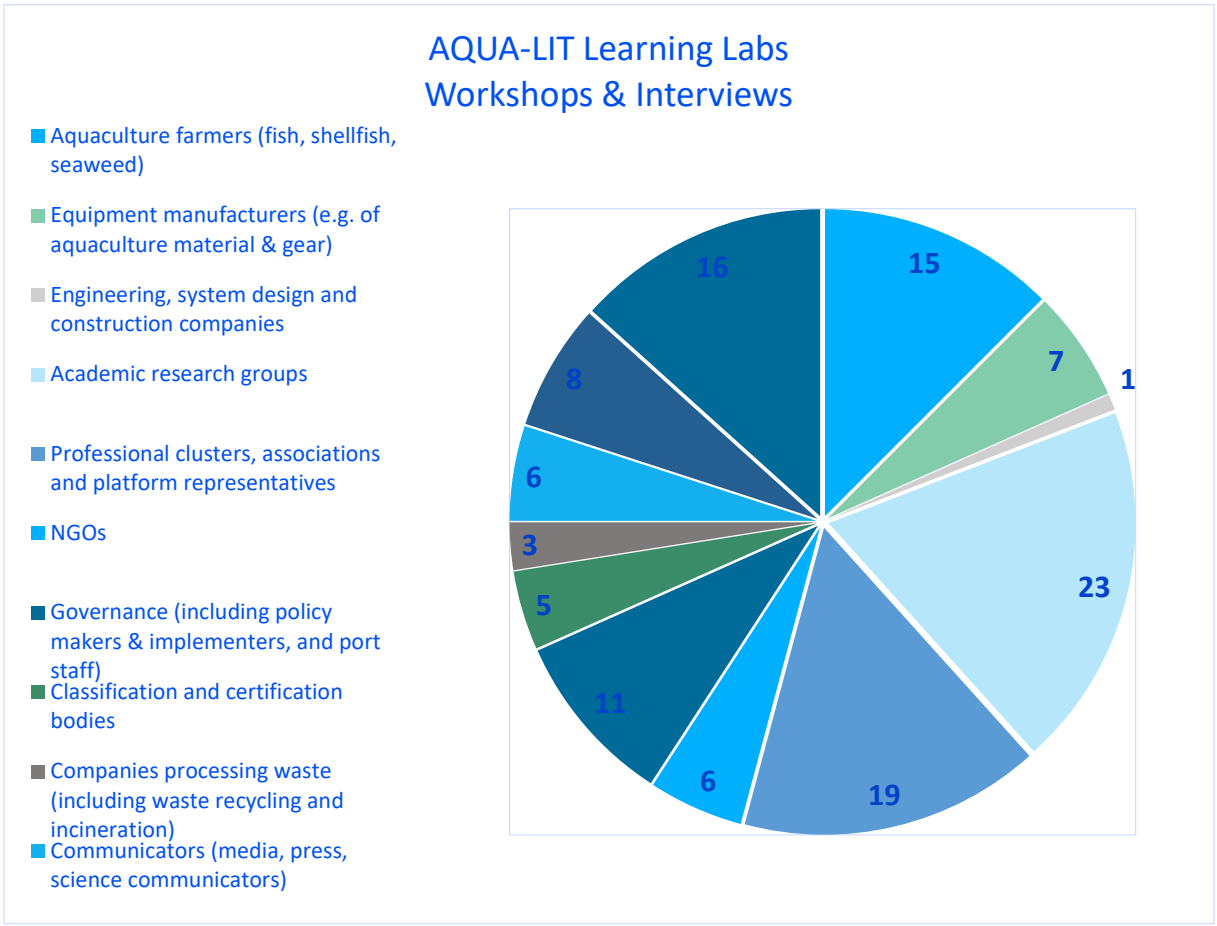


Fig.1 Number of participants per stakeholder group

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Throughout the process the stakeholders identified barriers, needs and solutions focusing on three measures that the aquaculture sector could adopt to address marine pollution: (1) prevention and reduction, (2) monitoring and quantification, and (3) removal and recycling of marine litter.

Next, they discussed the business processes, mechanisms and methods that they had already managed to establish on a local scale in relation to the three measures. The aim was to identify and collect cases of good practice that can be replicated, adapted to other situations and, eventually, become a standard or serve as models. As a result, this portfolio of good practice has been compiled for three sea basins. It has been enriched by desk research.

The fact sheets presented in this deliverable assemble good practice that relate to the lifecycle stages of an aquaculture farm where they can be implemented: Initiation, Development, Operations and End of Life. This indication helps to identify which stakeholder categories can be involved.

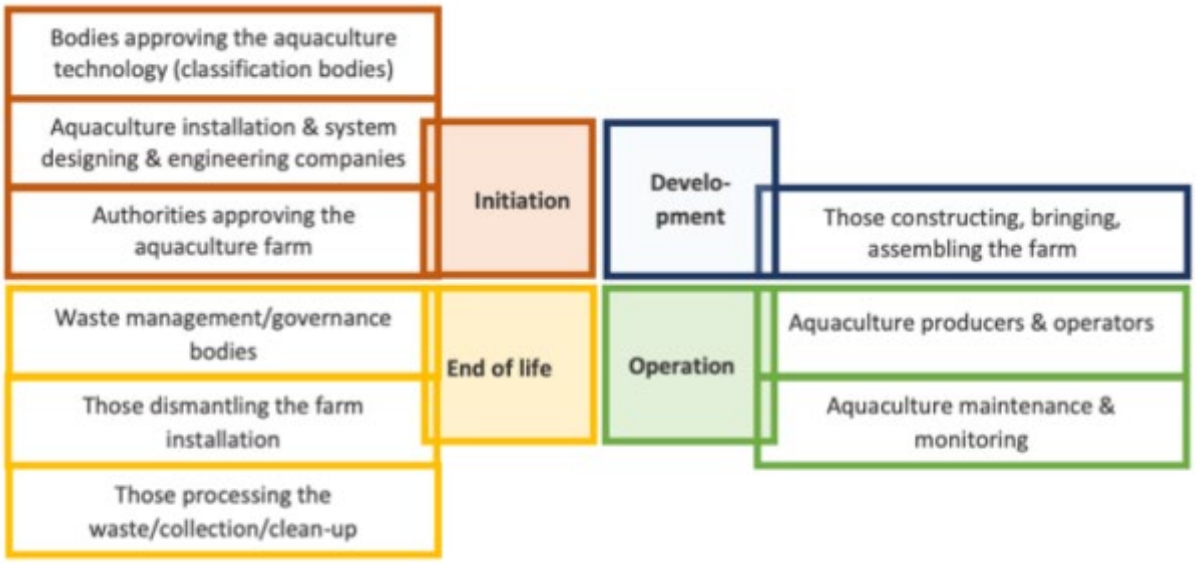

Fig. 2 Stakeholder categories in regard to the life cycle of an aquaculture farm

This portfolio is not exhaustive and an online form is open on the AQUA-LIT website for the stakeholders who would like to add more examples of good practice: https://aqua-lit.eu/articles/23/share-your-actions.

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Best practice or good practice?

A **best practice** is "*a working method or a set of working methods that is officially accepted as being the best to use in a particular business or industry, usually described formally and in detail" (Cambridge Dictionary), or "a procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption" (Merriam-Webster Dictionary).*

A best practice is a feature of accredited management standards such as ISO 9000 and ISO 14000 families.

The ISO 9000 family is a set of standards relating to quality management systems (QMS). They help organisations to ensure that they meet customers' and other stakeholders' needs related to products or services in the framework of regulatory requirements. (www.iso.org)

The ISO 14000 is a series of standards related to environmental management, i.e. the management of the interaction and impact of human activities on the environment. Their purpose is to help organisations (a) to minimize how their operations and processes negatively affect the environment (i.e. cause negative changes to air, water, or land); (b) to comply with laws, regulations, and other environmentally oriented requirements; and (c) to continually improve in the above (a) and (b). The ISO 14000 series of norms provide practical tools for companies and organisations looking to manage their environmental responsibilities." (www.iso.org).

The ISO 14000 series of norms is based on a voluntary approach to the environmental regulation. The norms are not specific to one industry and can be applied to organisations of any size. The ISO 14000 standard contributes to the Sustainable Development Goals of the United Nations Organisation: 1, 2, 3, 4, 6, 7, 8, 9, 12, 13, 14 and 15.

The conformity to both series of norms require certification audits against evaluation criteria by third party organisations.

Other definitions describe best practice as a method or technique or function or process that produces results that are consistently superior to those achieved by other means, demonstrate effectiveness and efficiency related to process, impact and outcomes, and that can be sustained in the long term adapting to social, economic and environmental requirements of the context in which it is developed (J. Ryan, 2016).

The Food and Agriculture Organisation of the United Nations defines **good practice** as follows: "*A good practice is not only a practice that is good, but a practice that has been proven to work well and produce good results, and is therefore recommended as a model. It is a successful experience, which has been tested and validated, in the broad sense, which has been repeated and deserves to be shared so that a greater number of people can adopt it.*" (FAO, 2015).

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In this perspective, **"good practice" can be considered as a management term whereas "best practice" can be understood as a proven standard or model** that has been assessed against a set of evaluation criteria and indicators and approved widely. In other words, good practice may become best practice and led towards standardisation, once it has been repeated, replicated, widely tested, assessed and documented.

The cases of practice that have been proposed by the stakeholders throughout the AQUA-LIT project activities and listed in this portfolio have proven to be successful on an individual and local scale. Their potential for replication among other organisations is not yet proven. They need to be assessed and tested against objective evaluation criteria on a larger scale so as to determine whether they could become a best practice or a standard. These evaluation data and evidence will have to be provided by another study because they require an assessment process over a long period of time. A proper impact assessment of the good practice and benefit to the marine environment would need further analysis in a potential new project as a follow up of the AQUA-LIT project.

Therefore, the term **"good practice" is preferred** and has been used **in this paper to define a process or methodology that is ethical, fair, has been shown to work well, succeeds in achieving its objective(s), shows potential for general adoption by entities performing similar activities, and** therefore, **can be recommended as replicable and suitable for upscaling**. The term 'good" is preferred to 'best' also because aquaculture practices are continuously evolving and improving and today's best practice can become a tomorrow's norm (IUCN, 2009).

The good practices included in this portfolio result from a consensus of aquaculture producers and a wide range of other stakeholders at all levels (from large companies to small-scale producers). Suggested in a participatory approach and consultation, we hope that they will be comprehensive, easily understood and broadly acceptable by the aquaculture sector.

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2. Good Practice Sheets

2.1 Prevention and Reduction of Marine Litter

Alternative materials of natural and bio-degradable fibres for mussel larvae collector lines and socks

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

In France since 2013, the Ministry of Agriculture, Agrifood and Forests made it mandatory to use mussel larvae collector lines that are made of natural and degradable fibres such as hemp or coconut ropes for products labelled as Moules du bouchot (French– traditional specialty garantee).

In the Netherlands, the use of biodegradable socks for mussel suspension cultures and mussel larvae collector installations as an alternative for cotton socks is a significant improvement to reduce litter that is harmful to the environment if gears are lost or damaged at sea.

Examples and/or locations

French regulations,

Machinefabriek Bakker from Yerseke, the Netherlands

Sustainability award of the shellfish conference foundation

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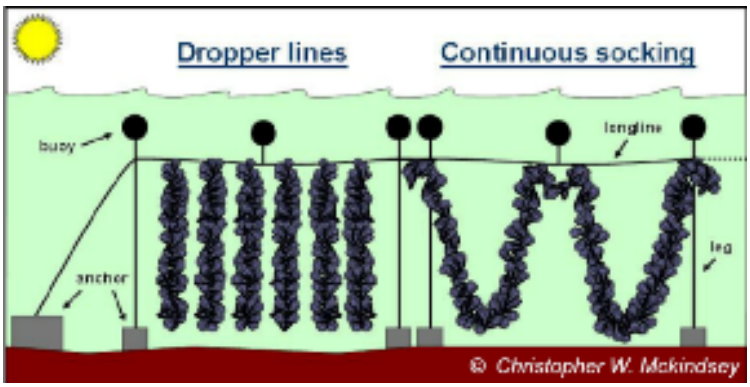
Alternative devices to mussel pegs

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

The mussel farms usually submerge vertical ropes for mussels to attach and grow up. To avoid the mussel detachment, plastic sticks called mussel pegs or stoppers with a length of 22 cm and a width of 2 cm on average are used. These mussel pegs can be lost when the mussel extracting activity takes place. In Sweden, Finland or in the Shetlands mussel farmers use continuous lines or loops instead of mussel pegs.



Examples and/or locations

Sweden, Finland, Shetland Islands

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Awareness raising workshops

Type of aquaculture: All

Lifecycle stage: Operations

Description

In the framework of the Interreg project Marelitt Baltic there were organised workshops aiming at engaging fishermen while utilising their expertise related to hot spots of ghost nets and their knowledge of ship wrecks and historical fishing effort data. In parallel, the foundations were laid for a change in attitude towards more sensitive topics such as prevention methods. This approach can be replicated in the aquaculture sector.

ProSea foundation in the Netherlands has provided marine awareness courses to maritime professionals for 20 years. ProSea has developed educational materials for the shipping industry to teach them how to deal with marine debris and organises workshops for professionals in the fisheries and shipping sectors. Similar workshops for the aquaculture sector professionals could help to reduce marine litter.

Examples and/or locations

MARELITT

ProSea foundation

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Production and use of nets made of a single material

Type of aquaculture: All

Lifecycle stage: Operations

Description

The use of nets made of a single material will greatly improve their recycling process. The recycling of fishing and aquacutlure gear is especially difficult due to the deterioration of the materials that remain in salt water for a long time. This deterioration decreases the value of the materials to be recycled. Moreover, the aquaculture gear is frequently made of several materials, which makes recycling costly as it is difficult to separate different types of materials during the recycling process.

Designers and manufacturers of the aquaculture gear should be encouraged to innovate and create products that can be recycled more easily. Making fisheries and aquaculture nets of the same material will optimise the recycling process.

Examples and/or locations

Remora

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Certifications and labels

Type of aquaculture: All

Lifecycle stage: Initiation

Description

Accredited certification bodies perform the verification of the control points at primary production. There are many certification bodies accredited to do aquaculture audits and certification worldwide. The accreditation system is based on ISO17065.

The main role of the certification bodies is to ensure that the aquaculture companies are complying with specific criteria that include multiple aspects related to fish farming: environmental criteria, ecological production, animal welfare, among others. Criteria for waste prevention and management are included in the aquaculture standards. In some cases, the criteria include using gear which is certified according to national legislation.

The Aquaculture Stewardship Council (ASC), an independent international non-proft organisation manages a certification and labelling programme for responsible aquaculture worldwide. It has been working on measures to reduce marine pollution by plastic and the ASC standard to encourage responsible use of plastics in aquaculture. A white paper *Marine Litter and Aquaculture Gear* that addresses this topic was published in November 2019.

In addition to the international standards, there are specific national guidelines provided by certification bodies in Spain and national regulations in France.

In terms of installations, French operators of marine aquaculture facilities, except shellfish farms, with a producing capacity over 5 tonnes of fish per year, must comply with the regulations of *Classified Installation/Facility for the Protection of the Environment* defined by French national decrees. They must request an authorisation before putting their farm into service and prove that the farm and operations meet the technical measures for prevention of environmental risks and nuisances defined in general prescriptions and regulations.

Examples and/or locations

Spanish Ministry of Agriculture
Agence française pour le développement et la promotion de l'agriculture biologique, Regulations of *Classified Installation/Facility for the Protection of the Environment* (ICPE - Installation Classée pour la Protection de l'Environnement), France

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Commitment to remove installations by producers in case of environmental problems

Type of aquaculture: All

Lifecycle stage: Initiation

Description

Finland is testing the approach to commit the producers of installations to provide a guarantee to fish farmers at the selling process that the installation will be removed in case of problems (e.g. storms). However, companies producing such installations have taken matters to court and a judgement has not yet delivered.

Examples and/or locations

Finland

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Compulsory removal of installations during disposal processes

Type of aquaculture: All

Lifecycle stage: End of life

Description

In Germany those installing the aquaculture farm are not allowed to leave any litter behind when dismantling a facility. Aquaculture business is considered as any other industry when it comes to disposal of broken parts or dismantled units: the aquaculture related industrial waste is not to be disposed as a general garbage (except for those elements particularly permitted).

In France, according to the *Classified Installations for the Protection of Environment* decrees, the aquaculture operator is under obligation to take measures of site restoration such as the evacuation or elimination of dangerous products and waste after the cessation of activity. They must place the installation site in such a state that it cannot harm the interests of neighbourhood, health, security, agriculture, nature conservation, environment, landscape, energy use and conservation of historical monuments and archaeological heritage and allow for the future use of the site and monitor the impact of the installation on its environment, if needed.

Examples and/or locations

German regulation

Regulations of *Classified Installation/Facility for the Protection of the Environment* (ICPE - Installation Classée pour la Protection de l'Environnement), France

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More regional pilot projects and cross-border cooperation

Type of aquaculture: Finfish

Lifecycle stage: Operations

Description

The primary goal of the Baltic-IMTA project was to convert an existing network cage system in the Baltic Sea off Rostock (type Barth from GDR times) into an integrated multitrophic aquaculture system (IMTA) and to scientifically support the material properties and selection of more sustainable products. The pilot project was co-funded by the European Maritime and Fisheries Fund (EMFF)

Examples and/or locations

Rostock University

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Cradle to Cradle Lab

Type of aquaculture: All

Lifecycle stage:

Description

The Cradle to Cradle Lab (C2C Lab) NGO offer labs for special stakeholder groups such as designers, food producers as well as other sectors to exchange ideas and gain knowledge about new ways of production cycle, with a view to reduce marine littering coming from marine sectors like aquaculture. The aim is to not only reduce the ecological footprint of producers and consumers but also to enable them to have a positive footprint due to new resource management and prevention measures.

Examples and/or locations

Cradle to Cradle

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Synergies among aquaculture stakeholders to facilitate the prevention and reduction of non-organic marine litter

Type of aquaculture: All

Lifecycle stage: Operations

Description

In order to enhance communication and cooperation among the aquaculture stakeholders, seafood farmers, farmer associations, Protected Designation of Origin (PDO) organizations or good practice certification bodies and policy makers (at Spanish and European level) are involved in Spain.

A Spanish PDO organization is strongly linked not only to the associated shellfish farmers, but also to the regional Spanish and European policy makers (members of the PDO governing body although not allowed to vote), to the European Molluscs Producers Association (EMPA), Spanish Advicer Assembly of Marine Cultures (JACUMAR in Spanish abbreviation), among others.

Examples and/or locations

Protected Designation of Origin certification body, Spain

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Good practice guidelines for shellfish farming to fight against marine litter

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

The Spanish Protected Designation of Origin (PDO) organization published online guidelines about good practices related to marine litter in 2018. These guidelines are specific to the shellfish farming sector. The aim of the publication is to increase awareness in the sector on marine litter and to encourage applying good practices.

Examples and/or locations

Protected Designation of Origin certification body, Spain

StartupStockPhotos from Pixabay

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Extended life-cycle of nets by their regular maintenance

Type of aquaculture: All

Lifecycle stage: Operations

Description

Regular net maintenance schemes including washing, disinfection, repair and applying anti-fouling treatments, among others, extend the life-cycle of the netsregular maintenance scheme. There are many international companies that produce aquaculture gear which also provide maintenance services, mainly aquaculture nets, in many areas of the world One of them is Amposta, in Catalunya, Spain.

Examples and/or locations

Amposta, in Catalunya, Spain

Guy Dugas de Pixabay

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Regional aquaculture consortia to manage development and operations of mussel farms

Type of aquaculture: All

Lifecycle stage: Initiation

Description

Recently, two mussel farming consortia Areas of Organized Development of Aquaculture (POAY), have been established in in Greece. They will be governed by a Board of Councils, composed of members who are representatives of municipalities, farmers and other authorities. POAY Thermaikos, will manage the activity in the northern part of the Thermaikos gulf, whereas the POAY Pydnas – Makgygialou will manage the activity in the southern part of the Thermaikos gulf. Stakeholders in charge of the POAYs expect that the full function of the consortia will change the situation radically, with better management and legislations, including waste monitoring and management.

POAY were defined by the Greece Government in the Law 2742/1999 *Spatial Planning, Sustainable development and other provisions* and the *Strategic Plan for Aquaculture* (2002) with the aim of identifying suitable areas for the development of aquaculture (FAO, 2020).

Examples and/or locations

POAY Thermaikos, North of Greece

POAY Pydnas – Makgygialou

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Flexible permits adapted to local conditions

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

Mussel larvae collector lines in the Netherlands, Denmark and Germany do not have the permit to remain at sea all year round, a solution to prevent potential loss. Instead they are allowed at sea from March 1st to November 1st and have to be taken out of the water every winter because of the storm season and the potential loss this generates. This is already settled during the licensing process.

Examples and/or locations

Regulation of the Netherlands, Denmark and Germany

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Gear marking and GPS trackers to locate gear

Type of aquaculture: All

Lifecycle stage: Development

Description

Marking of aquaculture gear is an effective solution to reduce marine litter. Several techniques are available: specially coloured braided ropes, tags, transponders…

These techniques allows for quick identification of damaged gear and therefore speed up its repair. The use of transponders even allows equipment to be spotted from a distance and underwater.

Examples and/or locations

Canadian and Danish regulations.

In Canada, the ropes must have identifiers of the region, species being fished and individual fishing area. The requirement is also intended to maintain access to the U.S. seafood market by demonstrating Canada has rules comparable to those in place for fishermen in USA.

Lost Gear Finder – in response to current Norwegian regulations compelling fishermen to search after lost gear, Furuno Norge AS launched the Lost Gear Finder in 2019. It is a technical system of transponders, transducers and processors that enable fishermen to search for lost gear's position underwater. The technology has been tested with satisfactory results and hopefully it may be replicated in the aquaculture sector.

MARELITT – in the framework of the project Marelitt, new ways of marking have been researched in laboratory and field tests during authentic fishing and aquaculture operations jointly with engineers. The objective was to develop a modern, practical high-tech solution for fishing gear marking allowing automatic identification and processing of recorded “in situ” data. The developed solution is a low-cost “smart tag” based on UHF RFID technology. The tag can be used with both new and existing fishing and aquaculture gear.

This project has received funding from the European Union’s EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Producer guarantee for removing gear

Type of aquaculture: All

Lifecycle stage: Operations

Description

In Denmark, aquaculture farmers have to pay a fee (or even a penalty) if the installations were not removed on time.

Therefore, at some smart farms, farmers subscribe a guarantee for removing the gear in case of a storm or other risks. This is based on Danish environmental law (water pollution). The environmental authorities (in most cases the municipalities) initially issue a notice when water pollution occurs. Aquaculture installations are acknowledged as water pollution after having sorted out. Typically, the polluting entity is ordered to clean up any pollution. The polluting entity means the individual or legal entity (company) carrying out the activity causing the pollution.

If an enterprise fails to comply with notices issued by the environmental authorities, the supervisory authority (the Environmental Protection Agency or the local municipalities) can issue an injunction against the entity. If an operative order or a prohibition order is not complied with, the supervisory authority can take measures, which the party responsible for the pollution must pay for.
To show the willingness to comply, some aquaculture farmers subscribe a guarantee before installing a plant.

Examples and/or locations

The Environmental Protection Act (EPA) (*Consolidated Act no. 879, 26 June 2010*), especially rules and decisions concerning the impact on waters sanctioned by penalties (section 110, EPA).

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Improved requirements for ASC standards

Type of aquaculture: All

Lifecycle stage: Operations

Description

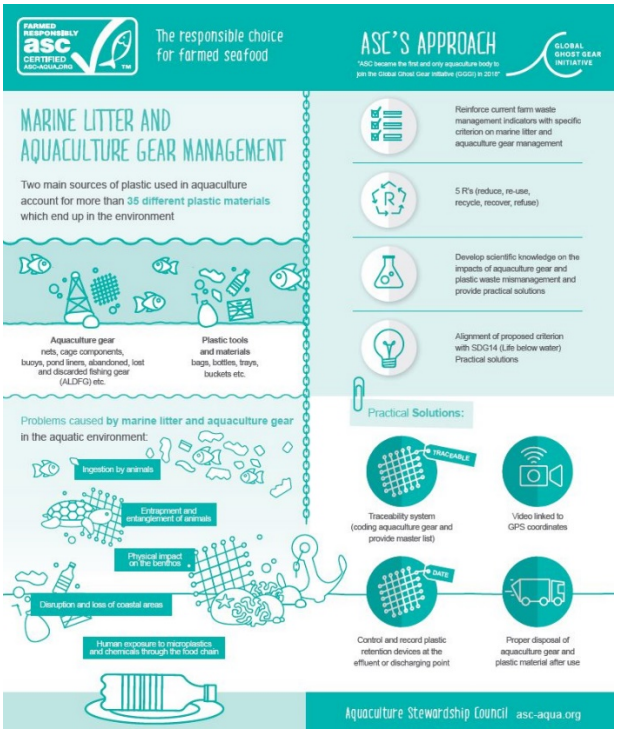
A white paper *Marine Litter and Aquaculture Gear*, published by the Aquaculture Stewardship Council (ASC) in November 2019 provides scientific rigour and evidence to the planned update of the ASC standards and includes recommendations for the wider industry. It gathers evidence from various sources including 60 ASC certified farms; and finds that the three main causes of plastic pollution generated by aquaculture can be classified as: mismanagement, deliberate discharge, and extreme weather.

ASC is looking to revise current standards to include plastic waste management as a criterion in their labelling. ASC is also involved in the Global Ghost Gear Initiative (GGGI), pledging to develop scientific knowledge on the impact of plastic waste and aquaculture gear used in farming.

Examples and/or locations

Aquaculture Stewardship Council (ASC) – Focus on Plastics, Marine Litter and Ghost Gear

Mowi collaborates with ASC (Aquaculture Stewardship Council) on a certification programme to include plastic-specific indicators in their standards update across Mowi farms on an international level.



Design: ASC

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Measures related to the prevention of litter in national strategy plans for aquaculture

Type of aquaculture: All

Lifecycle stage: Initiation

Description

The national strategy plan for Sweden foresees an increase of mussel production in the Baltic Sea up to 10.000 t per year and a strong increase of (micro-) algae production in the years to come. It also includes preventive measures to reduce marine litter derived of aquaculture, that will be incorporated into the licensing process.

Examples and/or locations

Swedish regulation

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Incorporation of decommissioning plans at the beginning of the licensing process

Type of aquaculture: All

Lifecycle stage: Initiation

Description

In Germany, e.g. in the Federal State of Schleswig-Holstein, a decommissiong plan of an aquaculture farm is presently, at least in part, incorporated in the licensing procedure, and can serve as a good practice example to other states/countries. Still there is room for improvements.

In most other EU countries similar systems are not applied yet and it should be investigated how complex an implementation would be there. In any case, responsible authorities should try to achieve harmonization on decommissioning to avoid unfair competition between EU member states.

Examples and/or locations

Schleswig-Holstein regulation, Germany

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

New university degree courses on alternative materials for gear

Type of aquaculture: All

Lifecycle stage: Initiation

Description

The University in Halle in Germany established a new master degree course to work on alternative gear materials. It is linked to the subject "environmental analysis and chemistry" and offers to interested students the opportunity to research on new alternative materials to harmful products. One research focus is on fishing gear and how to replace plastic.

In addition, the project STELLA is developing alternative fishing and aquaculture methodologies to reduce bycatch; a small part of the project is dedicated to analysing new materials to reduce the harmful impacts of plastic gear to the marine environment (https://www.thuenen.de/index.php?id=6667&L=0). The research team of the Thünen-Institute cooperates with the master degree course at the University of Halle.

Examples and/or locations

Halle University, Germany: https://studienangebot.uni-halle.de/chemie-master-120

Photo: SUBMARINER

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Investment in high quality gear

Prevention & Reduction

Mediterranean Sea

Type of aquaculture: All

Lifecycle stage: Operations

Description

Aquaculture farmers purchase very resistant anti-predator nets for mussels farming. Those nets can be considered as a preventive measure for reducing the gear losses. They are selected by the shellfish farmers depending on their resistance, to maximize their use. Once they have reached their end-of-life, mussel farmers clean them, dry them off and bring them to the larger-items waste management collection points, which is the best current practice, while there is no specific Emergency and Preparedness Response (EPR) system in place.

Examples and/or locations

Muscleres González, Menorca, Spain.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Regular maintenance of offshore installations

Prevention & Reduction

North Sea

Type of aquaculture: Finfish

Lifecycle stage: Operations

Description

The lifespan of aquaculture gear can be improved by dismantling the offshore installations every year and bring them on land for maintenance as soon as the fish have been harvested at the end of the production cycle.

Examples and/or locations

Every year in a French sea trout aquaculture farm, the offshore installations are dismantled as soon as the fish have been harvested at the end of the season and brought on land for maintenance. They are landed with the help of the current. The cages are made up of walkways and oak bows connected by galvanized steel hinges. Their buoyancy is ensured by polystyrene boxes. The entire system of cages has been internaly produced by the farm and, as of now, it has served more than 30 seasons at sea.

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This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Replacing buoys and floats by steel poles in Mussel Seed Capture Installations

Type of aquaculture: Shellfish

Lifecycle stage: Initiation

Description

In the Dutch Wadden Sea and Oosterscheldt, long steel poles were introduced to reduce the loss of floats and buoys in Mussel Seed Capture Installations (MZI's). These metal poles are fixed a few meters deep in the seabed and horizontal lines and ropes are attached to them to collect mussel seed. The installations have been improved and became robust over the years.

The lines and ropes can be deployed in the sea from 1st March to 1st November, at a time when large numbers of larvae are present. Then they have to be taken out of water, which prevents their loss or damage during the storm season.

Examples and/or locations

Locations in the Wadden Sea and the Oosterschelde in the Netherlands monitored by the Dutch Ministry of Agriculture, Nature and Food Quality.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Ressource-efficiency programmes

Type of aquaculture: All

Lifecycle stage: Initiation

Description

Some Baltic Sea countries like Denmark, Sweden and Germany installed the so-called resource-efficiency programmes to foster research and designers to use more re-usable, easy to recycle materials for fishing and aquaculture nets and other gear types.

Examples and/or locations

Denmark, Sweden and Germany

StartupStockPhotos from Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Re-usable mussel collectors and socks

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

Using reusable mussel collectors instead ofdisposable mussel socks helps to reduce significantly Abandoned, Lost Or Otherwise Discarded Fishing Gear (ALDFG).

A seaweed farm, certified according the EU-Eco-regulation is also avoiding litter with re-usable products and additionally improves the habitat by diverse structures due to the macro-algae farming.

Examples and/or locations

oceanBASIS GmbH, Kieler Förde, Germany

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Return of net bags and sacks used for mussel transportation to wholesale and processing companies back to the farm

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

Nets bags and sacks are usually in good state, as they are only used for mussel transportation from an aquaculture farm to the final consumer or to the processing company. Therefore, in case of direct marketing, farmers can request their clients to return those items once mussels have been removed and, thus, reuse them with no extra cost. This is currently done by the Menorcan mussel farmer Muscleres González and the mussel farmers associated to a Spanish Protected Designation of Origin (PDO) organization.

Examples and/or locations

Menorcan mussel farmer Muscleres González and the mussel farmers associated to a Spanish PDO organization.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Scheduled maintenance and surveillance plans of the good status of the shellfish installations

Prevention & Reduction

Mediterranean Sea

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

Spanish shellfish farms are regularly (although not following a schedule) checked by their owners to ensure that there has not been any loss or damage to the equipement. Moreover, port authorities perform scheduled checks of the farming installations in Spain.

Examples and/or locations

Menorcan mussel farmer Muscleres González.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Shifting to alternative types of mussel production techniques such as a Smart Farm system

Type of aquaculture: Shellfish

Lifecycle stage: Development

Description

Due to its structure, the Smart Farm or New Zealand system in mussel farms performs better than the longline technique because it is more resistant to storms and, therefore, it decreases the possibility to lose products and nets in the water. The system is based on the use of a cable or a beam anchored to the sea bottom by heavy weights and maintained at a depth of about 3 meters under the sea surface by floats.

The mussels are bred on a continuous rope called "watershed", which is fixed to the beam by silhouettes spaced every 8 meters and positioned along the row with a serpentine pattern. They are kept compact on the rope in special water-soluble cotton socks, which melt in seawater after a certain period of time. The type of rope, its diameter and mesh size depends on species that are farmed as well as the natural environment. The mesh gets its buoyancy from PE-Pipe and has bottom weights to keep it vertical in the water column. The mooring has been developed to keep the system in place in sheltered sites, winter iced fjords and open waters with waves up to 7 meters and significant to strong tidal sites with currents up to 4 knots. The system's expected life time in the water is 25 years or more.

The Smart Farm system is used more frequently in North Europe nowadays. It enables to cope better with waves and brings a number of advantages in relation to the safety of facilities and personnel, the limitation of product losses, as well as the reduction of environmental impact, as no plastic socks are used, which could detach and settle on the sea bottom. However, the tests in Italy reveal that the system might not work really well in stormy conditions.

Examples and/or locations

Smart Farm

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Specific company requirements preventing accidental losses

Type of aquaculture: All

Lifecycle stage: Operations

Description

By logging in every piece of material that goes onto the vessel and logging it out once back on the shore, compagnies can significantly reduce the quantity of materials lost at sea. The method used by submarine power cable compagnies has been very effective in avoiding losses of materials at sea and could be extended to aquaculture and fishing vessels

Making this practice a legal requirement for all fishing vessels and the aquaculture sector could reduce the accidental loss of fishing and aquaculture gear and equipment.

Examples and/or locations

SSC, Scotland is a company that lays subsea power cables in Scotland using this log method which is effective and less materials are lost at sea. This method is the policy of the company, not the legislation.

Baltic Offshore sea cable company

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Support for new European projects about technical improvements in the sector

Type of aquaculture: All

Lifecycle stage: Operations

Description

The European project InnoAquaTech (Interreg South Baltic), which has been dedicated to cross-border development and transfer of innovative sustainable and environmentally friendly aquaculture technologies for small and medium-sized aquaculture companies in the southern Baltic region. The project aimed at identifying best practice in integrated aquaculture systems and evaluating their agro-economic impact; creating a network of stakeholders; developing and implementing an SME service package consisting of matchmaking events, trainings, study visits and an innovation check tool; implemeting four pilot projects to gain hands-on experience in innovative aquaculture. The target group have been producers who were informed about current technologies at events and about innovative plant concepts through excursions and field trips, including capacity building about preventive measures and circular waste systems.

Examples and/or locations

InnoAquaTech – Denmark, Germany, Lithuania and Poland

thumprchgo de Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Sustainable aquaculture and circular economy project

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

The Acuieco project was initiated in 2019 as collaboration between a Spanish Protected Designation of Origin (PDO) organization and a research institution, funded under the Fundación Biodiversidad-PLEAMAR Call. The main aim of the project has been to reduce the impact of the marine litter related to shellfish farming activities by: encouraging best practice related to circular economy and involving gear producers and policy makers to identify the needs of the sector regarding this issue.

Examples and/or locations

Fundación Biodiversidad and Spanish Protected Designation of Origin.

ACUIECO PROJECT

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Technical studies to determine storm proof character of installation

Type of aquaculture: Seaweed

Lifecycle stage: Initiation

Description

In the Netherlands as well as in the Danish, Finish and German licensing processes, a technical study is mandatory to receive a permit for the installation of an offshore seaweed farm. This technical study must demonstrate that the installation is storm proof. Although there is never 100% certainty, this is likely to reduce the risk of damage to the installation.

Examples and/or locations

Danish, Dutch, Finish and German regulations

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Biodegradable fishing and aquaculture nets

Type of aquaculture: All

Lifecycle stage: Initiation

Description

Several initiatives are underway to develop nets or long-line ropes made of biodegradable materials. Still under study, these materials may prove to be less resistant and more expensive than plastic for the moment.

Examples and/or locations

NOVAMONT, Italy - NOVAMONT is an Italian innovative material production company that developed a new biomaterial for producing aquaculture mussels' nets. Together with Rom Plastics S.r.l., University of Siena and a mussel farm based in La Spezia managed by Cooperativa Mitilicoltori Spezzini, they are testing the new biomaterial in the lab and in the field. Nets are being tested in different ecosystems and sediments, in the lab and in the natural environment, to check their degradable time and resistance. The first trials gave positive feedback from farmers involved in the project. Once used, the nets can be placed in special containers for composting, thus reducing the price of their disposal, cleaning and recycling process. The material is still under refining process, since it proved to be less resistant and durable than plastic nets, and more expensive to be purchased.

BIOGEARS, AZTI - the project BIOGEARS, led by AZTI in collaboration with the Basque rope producer company Itsaskorda, is dedicated to long-line ropes made of biodegradable material.

TEFIBIO project is carried out by Parc naturel marin – Estuaires picards et la mer Côte d'Opale (Picardy Estuaries and Opal Sea Natural Marine Park), Seabird, Nautique Conseil, Océanic Développement and FROM Nord in France. It aims at testing prototypes of trammel-type fishing nets (or "sole nets"), made of biodegradable, bio-based and recyclable materials and studying their potential for marketing. the project is financed by European Maritime and Fisheries Fund (EMFF) and France Filière Pêche.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Efficient warning and communication systems about the location of offshore installations

Type of aquaculture: Seaweed

Lifecycle stage: Initiation

Description

The Dutch Noordzeeboerderij foundation implements preventive measures to make the sea farm pilots visible on sea maps and prevent their damage by ships sailing through the installations. They positioned measurement buoys equipped with AIS, big cardinal buoys and they call the ships that sail too close to the seaweed farm to warn them.

Examples and/or locations

Noordzeeboerdeij foundation

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

100% recyclable material for installations

Prevention & Reduction

Baltic Sea

Type of aquaculture:

Lifecycle stage: Initiation

Description

Some companies provide a range of semi-finished products and complete parts made of 100% recyclable materials for the aquaculture sector.

Examples and/or locations

ARTHUR KRÜGER company provides a range of semi-finished products as well as complete manufacturing of finished parts for the aquaculture sector: from design and manufacturing to assembly of 100% recyclable materials. They also test alternatives of glass-fiber-reinforced plastic (GFRP) constructions.

Photo: Rupert Kittinger-Sereinig, Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Compensation schemes

Type of aquaculture: All

Lifecycle stage: Operations

Description

Within the framework of marine environmental law there are compensation schemes, e.g. Civil liability and Fund Conventions regulating compensation for oil pollution damage caused by oil tankers. These schemes also include subsidiary or 'top-up' liability for cases where the actual polluter is not known (such as the oil industry's IOPC Funds, 2018). Their principal role is to pay compensation to those who have suffered oil pollution damage in a Member State and who cannot obtain full compensation for the pollution damage from the shipowner under the relevant Civil Liability Convention. An oil pollution incident can generally give rise to claims for five types of pollution damage: 1) Property damage; 2) Costs of clean-up operations at sea and on shore; 3) Economic losses by fishermen or those engaged in mariculture; 4) Economic losses in the tourism sector; 5) Costs for reinstatement of the environment.

Such compensation schemes could be adopted to the aquaculture sector.

Examples and/or locations

IOPC Funds

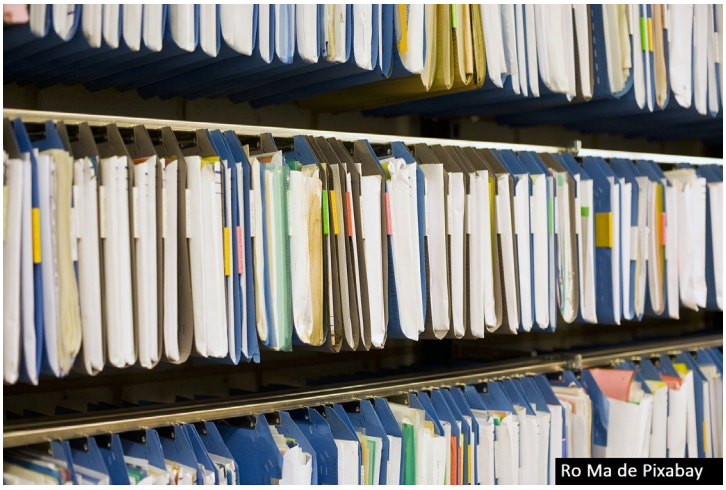
This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Updated documentation about best available technologies

Type of aquaculture: All

Lifecycle stage: Operations

Description


Ro Ma de Pixabay

In some Baltic Sea countries such as Poland and Sweden, utilization of updated documentation about Best Available Technologies (BAT) is considered the most efficient tool when communicating with the respective authority. Often, a municipal or communal authority has a very limited experience in dealing with aquaculture. In Germany, these documents are less frequently updated but they are developed by aquaculture experts from state authorities and, state-driven research institutions in close collaboration with producers and other experienced stakeholders. The BAT documents have the highest effectiveness and impact – also on the reduction of marine debris - when they are formulated by practitioners and other experts (including scientists), made publicly available and visually appealing, are regularly referenced in other contexts (e.g. as an industry standard in a marketing context) and are regularly reviewed.

Examples and/or locations

Germany, Poland, Sweden

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

2.2 Monitoring & quantification

Aerial monitoring

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

Aerial monitoring could be a valuable alternative or complementary to monitoring by ships. From the air, certain aspects are easier to monitor than from a ship, such as e.g. the detection of cables coming loose, the observation of an exceptionally fast growth rate of cultivated organisms. In the Netherlands, this system has already resulted in the detection of a large biomass of mussel growth, which was communicated to the mussel farmer and enabled him to harvest earlier than he planned originally.

The DRONET is an international organisation founded to develop open source protocols and tools for marine surveys. Members contribute by sharing images they have captured with drone cameras during beach surveys to develop, test and improve algorithms and survey methodologies. Each member must first agree on the Marine Litter DRONET Charter, which ensures there is a common understanding of the open and collaborative nature of the network. Members on the network exchange survey findings and experiment with new approaches. They discuss their surveying approach with other members and join a coordination forum for all members four times a year. The Baltic Sea members, such as e.g. the municipality of the Southern Swedish islands, discuss the possibility to use this method in selective monitoring of marine litter derived from fishing and aquaculture activities. They want to use the collected data for developing a programme of measures (PoM) as part of the adoption and implementation of the Marine Strategy Framework Directive (MSFD).

Examples and/or locations

The Netherlands; Sweden DRONET

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Seabed survey

Type of aquaculture: All

Lifecycle stage: Operations

Description

According to Danish law about waste management and circular design, the aquaculture companies that own fish cages are obliged to survey the seabed in order to assess the amount of litter they produce. The survey is flexible and will be continuously improved to meet the needs to better assess marine litter derived of this specific type of aquaculture.

Examples and/or locations

Danish regulation

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Improved monitoring schemes

Type of aquaculture: All

Lifecycle stage: Operations

Description

Sweden has a national litter fund that can be used for fostering and implementing innovative marine litter monitoring and management solutions, whereas the Aquaculture Stewardship Council (ASC), an independent international non-proft organisation has lauched the work to include marine littering prevention and monitoring as a criterion of its certification programme.


D. Schwarzenberg - Pixabay

The Spanish Ministry for the Ecological Transition and the Demographic Challenge (MITECO) is involved in the marine litter monitoring through two departments. Firstly, the Directorate for the Coast and the Sea has been involved in the monitoring of the marine litter on beaches for more than 12 years. In 2020, there are 26 beaches included in the monitoring scheme, which is performed by the MITECO technicians who follow a protocol and fill out a form in which the items are characterised by type of material (plastic, metal, wood, fabric, rubber, paper and glass) and, in some cases, by litter source. Secondly, the Deputy Directorate for Waste Prevention and Management develps a protocol (that, ideally, should be harmonised with the protocol used for beach monitoring) specific for waste monitoring on land. Currently, any specific item regarding the aquaculture activities is included in the official form.

Examples and/or locations

Swedish legislation

Aquaculture Stewardship Council (ASC)

Spanish Ministry for the Ecological Transition and the Demographic Challenge (MITECO)

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Incentives for compliance with monitoring and reporting schemes

Type of aquaculture: All

Lifecycle stage: Operations

Description


Brataffe- CC BY-SA 4.0 /Wikimedia

Establish a principle by which responsible aquaculture farmers will be rewarded. The core of this solution could be a voluntary "responsible aquaculture scheme" that interested farmers could commit themselves to. The scheme would expect compliance to a set of requirements (improved gear marking, better cooperation with control bodies, improved monitoring and reporting of gear loss) and in return the market could offer these aquaculture companies or family farms economic rewards such as promoting their "littering – free aquaculture" and paying a higher price for their products. At a local/regional level in the Skane county in Sweden, in the framework of the LEADER project that promotes locally-caught fish, there are plans , to include "ghost fishing-free" criterion for consumers to choose more environmentally-friendly produced fish . . This idea could be adapted to the aquaculture sector as well.

Examples and/or locations

Skane county, Sweden

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Increased synergies and communication among stakeholders

Monitoring & Quantification

Mediterranean Sea

Type of aquaculture: All

Lifecycle stage: Operations

Description

Targeted communication is a tool to increase awareness and to showcase current challenges that need to be addressed. For example, in Italy, in the framework of the project CleanSeaLife funded by the European Union, data on mussel nets stranded on beaches and seafloor along the Italian coast have been collected and presented to governmental institutions, farmers and other stakeholders increasing their awareness and willingness to find solutions.

@Agència de Residus de Catalunya

Examples and/or locations

CleanSeaLife

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

GIS platforms and apps to map marine litter

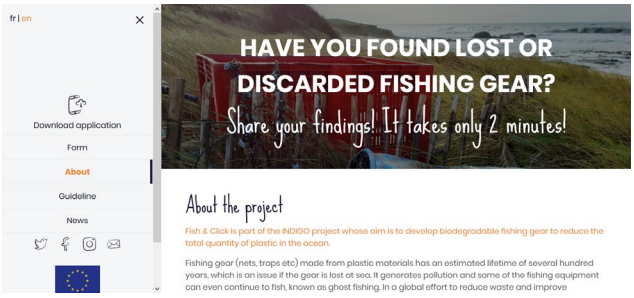
Type of aquaculture: All

Lifecycle stage: Operations

Description


Ifremer

The Marelitt Baltic project initiated cooperation with national institutions such as fishery monitoring centres and fisheries and aquaculture water management bodies to obtain the data. Various information was combined to identify zones with a large amount of lost gear. Geographic Information System (GIS) platforms have been used to ensure the best technological preconditions. Ideally, two maps should be developed: one showcase version and a more detailed version for planning.



In France, Ifremer launched a smartphone application Fish & Click in the framework of the IndIGO project. It is a citizen science programme in which the geneal public is asked to take pictures of the plastic fishing gear fragments they have found at sea or on the shore. They mark the type of material, the quantity, take a picture and indicate if any animals have been trapped. The data collected will be used to map the distribution of Abandoned, Lost Or Otherwise Discarded Fishing Gear, to suggest solutions for its management and removal,and to assess the impact on biodiversity. Some of the pictures will be presented in an raising awareness arts exhibition at the end of the project.

Examples and/or locations

MARELITT

Ifremer, Fish & Click

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Round tables to foster cooperation

Type of aquaculture: All

Lifecycle stage:

Description

In Denmark in relation to the revised circular economy framework, round tables on marine litter have been organised on a municipal level. Their objectif have been to discuss how to improve monitoring of specific SUP items related to fisheries and aquaculture. Local fishermen, aquaculture farmers and representatives of other offshore sectors are invitied to participate. Apart from improving data sharing, they foster transparency and trust among coastal stakeholders. They also aim at reducing costs of long-term monitoring.

In Germany, an initiative led by the Federal Environment Ministry, jointly with the Lower Saxony State Ministry for Environment and the German Environment Agency established a Round Table Against Marine Litter in March 2016. It aims at developing measures to counteract further pollution of the oceans and to raise the general public awareness of the problem and the need for action. The round table works along the guidelines of the Marine Strategy Framework Directive (MSFD). The participants develop recommendations for action to combat marine litter, focusing on specific legal frameworks and industry sectors, including aquaculture.

Examples and/or locations

Denmark, Germany

SNCR_GROUP de Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Acoustic devices such as the Passive Acoustic Transponder (PAT)

Monitoring & Quantification

Baltic Sea

Type of aquaculture: All

Lifecycle stage: End of life

Description

The project MARELITT Baltic will investigate acoustic devices such as the Passive Acoustic Transponder (PAT). Thanks to its individual identification number PAT can be read on specific frequences of ship sonars and 3D-Structure Scans to retrieve the Abandoned, Lost Or Otherwise Discarded Fishing Gear (ALDFG) at known locations. Depending on the orientation of the net in the water column or the seabed, barium sulphate added to nylon nets increased their acoustic detectability by sonar. Information of the occurrence of lost gear on the surface by high definition videos and the overview mapping technologies of underwater obstacles could provide valuable information guiding to areas where the ALDFG may concentrate.

Examples and/or locations

MARELITT

© JW Fishers

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

2.3 Removal & recycling

Alternatives to fish feed bags

Type of aquaculture: Finfish

Lifecycle stage: Operations

Description

In Scotland, feed for farmed fish which was originally delivered in small 25 kg bags is now delivered in one-tonne bags and lifted by a crane. Worn and damaged feed bags are taken away by the feed delivery boat and recycled, which reduces accidental loss and waste production.

Examples and/or locations

Scotland, UK

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Alternatives to silicon socks

Type of aquaculture: Shellfish

Lifecycle stage: Operations

Description

In some regions in France, the damaged silicon socks are collected for recycling and upgrading as an alternative to a costly deposit at the waste collection centre. This initiative is carried out at no cost and based on a voluntary approach.

Examples and/or locations

France

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Blue Deal

Type of aquaculture: All

Lifecycle stage:

Description

Blue Deal is an international programme of the Dutch Ministry of Foreign Affairs, the Ministry of Infrastructure and Water Management and the Dutch water authorities. They work on three essential elements to improve water management:

A. Sufficient knowledge & expertise

B. Well-functioning organisation

C. Cooperation with key stakeholders

Blue Deals are a voluntary agreement between aquaculture actors and the government in Belgium. It is a voluntary collaboration and supported by the federal state of Belgium.

Examples and/or locations

Belgium

The Netherlands - Blue Deal

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Collecting and removing marine litter near the aquaculture source

Type of aquaculture: All

Lifecycle stage: Operations

Description

Methodology for removing and preventing the abandonment of fishing gears at sea, including aquaculture nets.


Pexels - Pixabay

The Ghost project co-funded by the European Union's LIFE programme from 2013 ti2016 was based on a study conducted in the North Adriatic coastal areas and developed an operating handbook describing the methodology for an effective prevention and mitigation of fishing and aquaculture gear lost at sea. The handbook contains methods and protocols for the removal of abandoned gear, indications and best practice of waste management for fishing and aquaculture equipment and guidelines for fisheries and aquaculture operator engagement. The handbook has been designed for fishing and aquaculture stakeholders, public and private institutions and environmental associations engaged in actions for the protection of marine ecosystem against littering. The proposed methods are particularly suitable for shallow coastal areas, and for discarded fishing and aquaculture gear of small size.

Examples and/or locations

Ghost project -Technologies to reduce the impact of ghost fishing gears and to imporve biodiversity in North Adriatic coastal areas

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Cooperation of local NGOs to collect marine litter

Type of aquaculture: All

Lifecycle stage: Operations

Description

In some regions in France, after a storm, local NGOs (e.g. CAP 2000 in Brittany, Windsurf in Normandy, and Surfrider in Southern Brittany) in cooperation with regional shellfish committees organise beach cleaning activities to assist aquaculture farmers in locating and collecting their lost equipment.

Examples and/or locations

CAP 2000

Windsurf in Normandy, France

Surfrider in Southern Brittany, France

Wikimedia

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Cooperation of several aquaculture companies to collect marine litter

Type of aquaculture: All

Lifecycle stage: Operations

Description

SeaBOS (Seafood Business for Ocean Stewardship) has assembled 10 top world's largest seafood companies to align their policies of ocean stewardship and seafood standards relating to fishing and aquaculture. Their aim is to make retailers adopt those policies, which consequently would force the entire supply chain to introduce new standards and to have a visible impact on the seafood industry. One of their 6 task forces work on the topic of reducing ocean plastics – to ensure that SeaBOS members map the sources, presence and type of plastics in their seafood production, as well as identify ways to improve ocean health by removing plastics from the ocean environment. The task force work is based on scientific knowledge, existing best practice and innovation. The lead companies are: Thai Union, Mowi, and Kyokuyo; the lead scientific institution Stockholm Resilience Centre.

Other SeaBOS members are Maruha Nichiro, Nippon Suisan Kaisha, Dongwon Industries, Cermaq Group of Mitsubishi Corporation, Nutreco's Skretting division, Cargill and Charoen Pokphand Foods.

Examples and/or locations

SeaBOS

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Feasible EPR schemes based on Circular Economy and 5Rs approach

Type of aquaculture: All

Lifecycle stage:

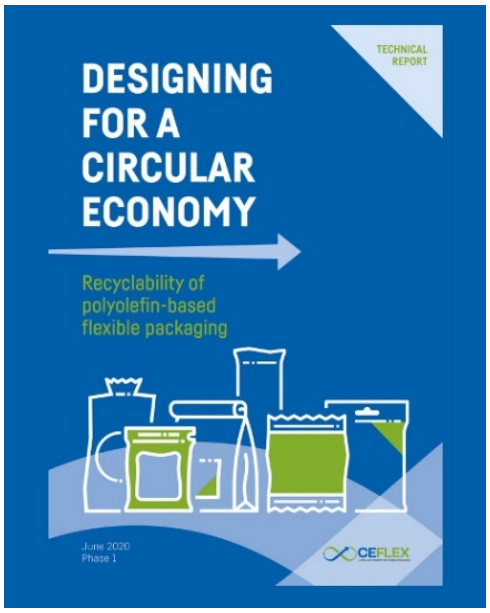
Description

In Italy, all plastic packaging producers have to pay a tax. They are members of a consortium that manages their taxes (CONAI) and the taxes are used for the packaging disposal process. A similar idea is pursued by the European consortium of companies and associations representing the entire value chain of flexible packaging (CEFLEX.EU). The CEFLEX mission is to further enhance the performance of flexible packaging in the circular economy by designing and advancing better system solutions identified thanks to the collaboration of companies representing the entire value chain. This kind of consortia can support partnership and common effort in finding valuable solutions.

Examples and/or locations

CONAI

CEFLEX



Designing for a circular economy guidelines by CEFLEX

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

An eco-anchor: scaling up sustainably

Type of aquaculture: Seaweed

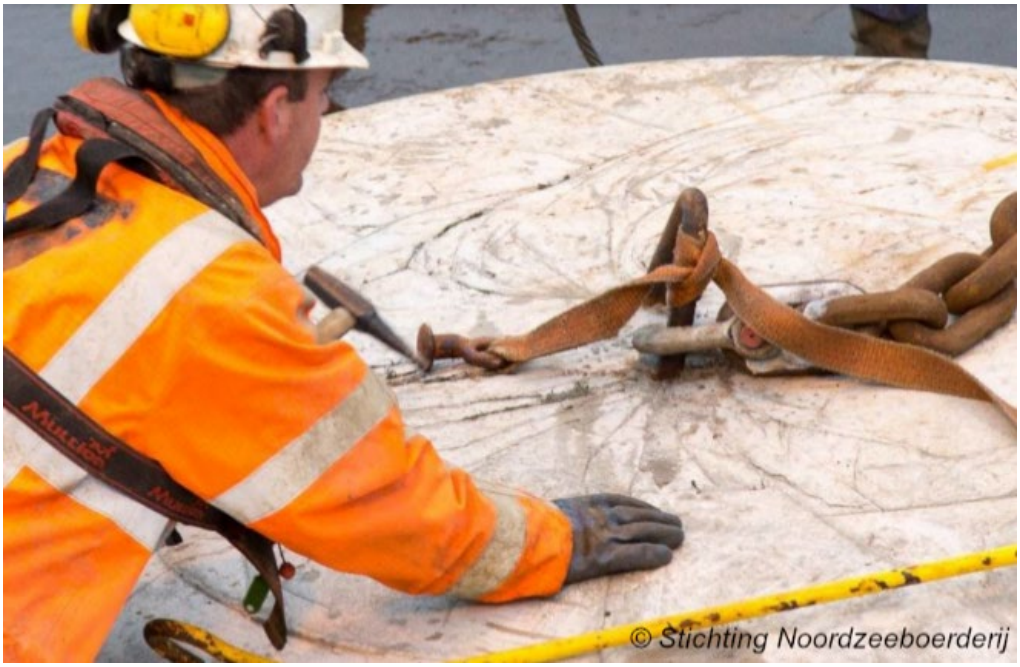
Lifecycle stage: Initiation

Description

To upscale the seaweed sector in a sustainable way, the Noordzeeboerderij foundation initiated a project that focuses on building a sustainable anchoring system; the foundation of every future sea farm. The anchor that holds the sea farm in place, will be nature-friendly and built from safe materials. During the dismantling of the installation, the eco-anchor can be left in place and be reused in the next season. In the meantime, the anchor can function to create nature.

Examples and/or locations

Noordzeeboerderij: Eco-anchor, a sustainable anchoring system



This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Environmental friendly boxes

Type of aquaculture: All

Lifecycle stage: Operations

Description

Traditionally, even today, the fish industry uses transport materials made of polystyrene, which have been used for intercooling for many years. By switching to Forest Stewardship Council approved cardboard boxes or to environmentally friendly reusable boxes, producers can significantly reduce their plastic consumption. The use of plastic can also be reduced by improving the design of Modified Atmosphere Packaging trays.

Examples and/or locations

Deutsche See

Mowi processing plant in Bruges, BELGIUM

Mowi has switched from using polystyrene boxes to Forest Stewardship Council approved cardboard boxes instead, which has further reduced their plastics use by 7 tonnes per year.

Since 2015, Mowi processing plant in Bruges, Belgium, has reduced the weight of Modified Atmosphere Packaging (MAP) trays by 20%, which in turn has reduced plastic consumption by 96 tonnes per year.

Nordshell, a Danish shellfish processing plant has switched from using polystyrene boxes to Forest Stewardship Council approved cardboard boxes instead, which has further reduced their plastics use by 9 tonnes per year

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Fishing for Litter

Type of aquaculture: All

Lifecycle stage: Operations

Description

Fishing for Litter is a recommendation by OSPAR to stimulate fishermen to keep the fished litter on their vessels and to bring it to the shore with the aim to monitor the types of litter that are being found. The project that aims to eliminate pollution in the Northern Seas was developed by KIMO (Local Authorities International Environmental Organisation), an association of coastal local authorities. The Belgian Marine Environment service supports the VVC Equipment foundation of the Flemish fishermen to take part in the *Fishing for Litter* initiative.

In Scotland, the Shetland Amenity Trust manages the operations of the *Fishing For Litter* scheme on the Shetland islands.

The German NABU supports the collection, sorting and monitoring of waste in many Baltic Sea ports and fosters the involvement of fishermen in the initiative. So far, aquaculture farmers are not part of the project.

In Italy, Salva Mare is a fishing for litter scheme under consultation. The directive *Salva Mare* allows fishermen to collect any type of plastic and nets found at sea, and to bring them to special collection sites, have been recently approved by the Italian chamber but it is still under final consultation. The directive, if approved, will encourage fisherman, and eventually seafood farmers, to collect waste encountered while fishing, including mussel nets and other aquaculture dispersed items.

Examples and/or locations

Ospar - Overview and assessment of implementation reports Fishing for Litter

Shetland Amenity Trust

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

NABU

Net-Works - The Net-Works project is a collaboration between global carpet tile manufacturer Interface Inc., the Zoological Society of London (ZSL), global synthetic fibre manufacturer Aquafil and local partners.

Salva Mare, Italy.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Graded taxation

Type of aquaculture: All

Lifecycle stage:

Description

In Norway, the manufacturers of beverage bottles and cans have to pay taxes on the products. This taxation is graded according to the return rate of the products and does not apply to a return rate of 95% complete [Osterath 2018]. The approach could be applied to some passive fishing gear.

Examples and/or locations

Norway

Hans Braxmeier from Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Improved plastic recycling methods

Type of aquaculture: All

Lifecycle stage: Operations

Description

Manufacturers with a very good knowledge of their equipment could set up more efficient recycling processes but also design products that are easier to recycle. Therefore, greater involvement of plastic-based equipment manufacturers in the recycling process could be decisive for the industry.

The Australian scientists may have discovered a solution to the plastic recycling problem. When China stopped taking Australia's recyclable waste in 2018, scientists have developed a technology that could make all plastic recyclable. The Catalytic Hydrothermal Reactor (Cat-HTR) does a form of chemical recycling that changes the plastics at a molecular level to turn them back into oil. From there, the oil can be turned into bitumen, petrol or back into different kinds of plastics (ABC news article).

Examples and/or locations

Maillard Industrie

In France Maillard Industrie designs and manufactures custom-made plastic equipment and installations and offers tailored services of plastic collection, sorting, transportation and processing, depending on type, state tate of cleanliness and volume of plastic debris.

Econyl

Nylon 6 waste is collected all over the world and sent to the Aquafil's ECONYL® waste treatment center in Ajdovščina, Slovenia. As part of the cleaning process, materials other than Nylon 6 are removed and sent to other supply chains. The cleaned nylon waste is shredded, compacted, bagged and transported to the regeneration plant in Ljubljana. Compared to mechanical recycling, the chemical process allows the plastic to return to the state of raw material removing all foreign substances to obtain 100% virgin quality. ECONYL® is used to manufacture socks, swimwear, carpet tiles, and a range of other products sold around the world.

Catalytic Hydrothermal Reactor

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Improved dismantling procedures of worn out equipment

Type of aquaculture: All

Lifecycle stage: Operations

Description

By strengthening partnerships with waste managers and subcontractors, companies can ensure a standardised process for waste treatment and thus reduce waste losses to the environment and develop new recycling processes.

Examples and/or locations

Mowi - In Norway Mowi established a national agreement with a waste managing body in 2019 to ensure a safe and standardized handling of the waste and easier access to the waste data. Also in Norway, Mowi started to roll out a new collaboration with a subcontractor where their feeding pipes will be collected and cut in a closed process to prevent cut fragments and microplastics from being released to the environment and ensure that the used pipes will be recycled into new products

Collaboration with waste managing organisation

Image par Dimitris Vetsikas de Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Increasing the awareness in the sector and among the consumers of the removal and recycling activities

Type of aquaculture: All

Lifecycle stage: Operations

Description

There exist international and Spanish removal, recycling and upcycling initiatives related to the marine litter. Although they are not strictly linked to aquaculture, they can be considered as the first step towards the sensibilization of the fishery and aquaculture sectors andopen up new opportunities and possibilities regarding recycling initiatives in both sectors.

The big majority of them are related to schemes like F*ishing for litter* and linked to recycling and upcycling initiatives A few are related to fishery gear directly, like the following ones:

1. In October 2019, the first tests to recycle and upcycle the fishing nets were conducted to produce sport clothing in the framework of a collaboration among AIMPLAS, research institutions, fishery cooperatives, Asociación Vertidos Cero and textile and clothing companies.
2. the project Xarxes is a Catalonian initiative that involves 14 Catalonian ports. Once nets have reached the end-of-life, they are brought and left in specific collection points located in the port facilities. A recycling company collects them and and sorts out the plastic elements that are in good status and that can be recycled. The sorted ut pieces are sent to another company located in Euskadi that transforms them into plastic scales, which can be used to produce multiple types of plastic products like glasses or phone cases.
3. Bluenet: this project involves 3 fishing ports of the Basque Country, accounting for 24 fishing vessels. Recovered nets and aquaculture ropes that have reached the end of life are being recycled and upcycled to produce aquaculture ropes for mussel production.

Sponsored volunteering activities to pick fishing gear, like the initiative supported by GLOBALG.A.P. were held in Almería (Spain) in 2019. During two days, more than 15 fishing traps, around 400 meters of ropes and fishing lines, 33 fishing weights and some fish hooks and baits were collected with the aim to increase the awareness related to marine litter.

Examples and/or locations

AIMPLAS:; Project Xarxes (Agència Catalana de Residus), Catalonia, Spain ;

BLUENET; Asociación Vertidos Cero / MARNOBA.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

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Local deposit for regional fishing association members

Type of aquaculture: All

Lifecycle stage: Operations

Description

A German specialist company dealing in fishing equipment, whose owner is a member of a regional fishing association (KAV), is taking a deposit of 50 cents on the plastic fishing bait boxes when selling baits (Breitbarth 2013). When the banks of the river Fulda in Kassel were inspected in 2013 by the waste technology department of the University of Kassel at the time, no such bait boxes could be found at the fishing spots on the river bank section of the KAV's lease area, while in the adjacent lease area of another fishing association such bait boxes were very commonand found in the water. The deposit system is based on trusted identification within the fishing association, the members of which are authorized to fish in leasehold waters.

Examples and/or locations

KAV, Kassel, GERMANY

Photo: Jamie Doran, Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Beach clean-ups as part of Corporate Social Responsibility

Type of aquaculture: All

Lifecycle stage: Operations

Description

Some compagnies organise beach cleaning activities for their staff and their families. More than just removing plastics and other marine litter, those kind of actions help to better understand the potential impact of aquaculture activities and raise awareness among the local communities.

Examples and/or locations

Mowi has organised a Global Clean-up Day every year since May 2018. Mowi staff and their families, joined resources and mobilised a community effort to clean local beaches of plastics and other marine litter.

Helmepa - the Hellenic Marine Environment Protection Association; a voluntary commitment of Greek seafarers and ship owners to safeguard the seas from ship-generated pollution, has organised "Clean Seas and Beaches" beach cleanup action in Greece as part of Corporate Social Responsibility.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Beach clean-up summer jobs for young people

Type of aquaculture:

Lifecycle stage: Operations

Description

Some compagnies are recruiting young people to clean beaches as summer jobs. These summer jobs help raising awareness among youth and train them to adopt good practice.

Examples and/or locations

CERMARQ: https://www.cermaq.com/

Every summer, CERMAQ organises a beach clean-up and employs young people to clean the beaches near the farm.

https://www.cermaq.com/wps/wcm/connect/2f44c1de-2264-44c5-8887-5aac36eecfaa/Cermaq+Group+Annual+Sustainability+Report+2019.pdf?MOD=AJPERES&CVID=n6xWM9p

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Beach clean-ups by local communities

Type of aquaculture: All

Lifecycle stage: Operations

Description

The Baltic Sea Challenge is one example of several existing initiatives to cooperate on beach cleaning. In the framework of this initiative several cleaning events are organised every year in e.g. Helsinki, Turku, Tallinn and St. Petersburg. Additionally Baltic Sea Challenge and Clean Beach campaign invite the member cities of the Union of the Baltic Cities (UBC) to organise their own events.

Da Voar Redd Up is the Scottish most successful community litter pick organisation, with over 20% of Shetland's population volunteering their time annually. This annual spring clean up makes an invaluable contribution to Shetland's natural environment and wildlife, clearing Shetland's beaches, coastlines and roadsides of litter and the debris washed up by winter storms. The aquaculture farmers use this initiative to clean more isolated beaches or islands using small vessels from their farms. The clean-up is sponsored by aquaculture producers.

Examples and/or locations

Da Voar Redd Up

The Baltic Sea Challenge

Scotland, UK

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Reuse of HDPE floats from salmon cages in horticulture

Type of aquaculture: All

Lifecycle stage: End of life

Description

The Northmavine Community Development Company (NCDC) in Shetlands, UK, has been finding alternative solutions to reuse equipment from the aquaculture industry, which was either sent to landfill or was littering shorelines before 2008. The NCDC incorporated these waste materials in the design of the hoops to grow more fresh food locally.

Examples and/or locations

NCDC

Polycrub

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Synergies among the aquaculture stakeholders and other sectors regarding removal and recycling of marine litter

Type of aquaculture: All

Lifecycle stage: Operations

Description

CleanSeaLife, a LIFE funded project working on marine litter in Italy, has involved Marine Protected Areas (MPA) authorities in a *Fishing for Litter* scheme. Carrying out a Fishing for Litter project together with local fishermen, the project partner organisations managed to engage fishermen in bringing plastic and litter found in their nets on land and disposing of it properly in collective sites made available temporarily by the local MPA authorities.

Examples and/or locations

CleanSeaLife

Matthew Gollop from Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Synergies among the aquaculture stakeholders and other sectors regarding removal and recycling of marine litter

Type of aquaculture: Shellfish

Lifecycle stage: End of life

Description

In Galicia, the structure of the bateas was traditionally made of eucalyptus. Once the batea had reached the end-of-life and was dismantled, the wood pieces were burned. But lately, decorators and architects have started using them as decorative element in houses.

Polycrub in Shetland, UK uses strong polyethylene pipes, recycled from the aquaculture industry, to build storm-resistant greenhouses. This avoids the need to send the pipes to landfills.

Examples and/or locations

SPAIN

Polycrub

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Synergies among the aquaculture stakeholders and other sectors regarding removal and recycling of marine litter

Type of aquaculture: All

Lifecycle stage: Operations

Description

In Spain, aquaculture farmers are currently managing the waste that is produced in their own installations, in collaboration with specialised waste managing companies whenever possible. In the recent national guidelines to minimise sub products and litter from the aquaculture activities (OESA - Fundación Biodiversidad, 2017), it is highlighted that, among the farmer's obligations related to any kind of waste, they have:

a) To ensure a proper treatment of the waste by themselves or by the authorised waste managing compagnies (bearing the costs of treatment or management).

b) To submit a waste minimization plan to the autonomous community in the case their aquaculture facilities produce hazardous waste (except for the smaller ones).

c) To keep the stored waste in good condition, following hygienic and safety recommendations. Hazardous waste can only be stored for six months maximum.

d) To avoid mixing or diluting hazardous waste.

e) To store, package and label the hazardous waste at the production place and following the regulations.

Recently, in the absence of a specific EPR scheme in place, a few projects have been developed about the waste management related to aquaculture activities in Spain, focusing on identifying innovative strategies for the recovery of aquaculture waste.

Examples and/or locations

National Guidance for the Minimization of the Sub Products and Litter of the Aquaculture Activities (OESA - Fundación Biodiversidad, 2017).

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Recycling programs for nylon nets and ropes

Type of aquaculture: All

Lifecycle stage: Operations

Description

The development of new recycling processes of nylon nets and ropes will avoid a large quantity of new plastics. The recycling process re-converts the netting into new polyamide filament, which in turn can be used in a variety of applications, such as in the manufacture of swimwear or carpet yarn.

Examples and/or locations

.

Recycling programmes of nylon nets and ropes by Mowi(p49)

In 2019 in Norway Nofir collected 24 tons of discarded fishing nets from Antarctica's oceans. After the nets were dismantled and cleaned, Nofir sent them off to Italy-based Aquafil to be processed into nylon yarn ECONYL®.

Nadine Doerlé from Pixabay

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Sorting out marine litter at collection points to facilitate recycling

Type of aquaculture: All

Lifecycle stage: Operations

Description

The installation of different containers to facilitate the collection of various materials at collection points can improve and facilitate the recycling process.

The recycling equipment should be provided in strategic sites/places where nets are deposited (e.g. ports).

Examples and/or locations

Plastix is a Danish cleantech recycling company specialised in converting fibres, primarily used fishnets, trawls and ropes. It has developed a technology, enabling the mechanical recycling of post-use plastic fibres and rigid plastics primarily from the maritime industry. It recycles only PE and PP. Other companies like Antex recycle PA. Plastix also tests the installation of different containers to facilitate the collection of various materials directly at collection points. The first result of this pilot project about sorting out at collection points has shown the need for training among aquaculture farmers and fishermen.

Bureo

Faced with a dynamic range of polymer-based pollution in the ocean, the Bureo team became aware of the complications, risks to the marine environment and lack of infrastructure for the proper disposal of waste fishing nets in Chile, Bureao launched *Net Positiva*, a fishing net collection and recycling programme. *Net Positiva* provides fishermen with environmentally sound disposal points, while Bureo receives highly recyclable and durable raw materials which they use to create skateboards and sunglasses. Additionally, the programme provides fishermen with easy options for disposal of old nets and helps them generate local funds through a material buyback program.

This project has received funding from the European Union's EASME-EMFF funding programme under grant agreement EASME/EMFF/2017/1.2.1.12/S2/04/S12.789391.

Waste companies testing regional approaches of net recycling

Type of aquaculture: All

Lifecycle stage: Operations

Description

Large waste companies started pilot projects to test the ability to recycle nets, even if they are very dirty due to a long period in the sea. These regional approaches could act as promising models for other recycling companies.

Examples and/or locations

ALBA started a pilot project supported by start-up funding.

Henri Apell from Pixabay

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3. Good and best practice criteria

Although the implementation of good aquaculture practices has been voluntary, after a period of time, some of them can be used as a source of guidance for government policy, administration and legal frameworks, and evolve into binding regulations (IUCN, 2009). Therefore, we present, in this section, a series of criteria that have been suggested in various activity sectors to determine and assess the good practice transferability and its potential to become a best practice or standard.

According to the International Union for Conservation of Nature, good aquaculture practices should (IUCN, 2009):

- Address the environmental, social and economic pillars of sustainability;
- Be based on the best available scientific knowledge. A solid science-based foundation is essential to make them credible and robust;
- Be built on consensus among aquaculture producers and other stakeholders. A participatory approach, including consultation with producers at all levels (from large companies to small-scale producers) and a wide range of other stakeholder representatives of government, private sector, NGOs, universities and research institutes, will result in more comprehensive content that would be understood and broadly acceptable;
- Be reviewed and adjusted regularly. In fast evolving sectors such as aquaculture, good practice needs to be periodically adapted to reflect the latest technological developments, new scientific research, and current issues faced by the sector;
  Be adapted to local conditions in order to make them applicable in different social, economic and environmental contexts.

In order to document good practice, the Food and Agriculture Organisation of the United Nations proposes the following dimensions (FAO, 2015):

- Effective and successful: A good practice has proven its strategic relevance as the most effective way in achieving a specific objective; it has been successfully adopted and has had a positive impact on individuals and/or communities.
- Environmentally, economically and socially sustainable: A good practice meets current needs, in particular the essential needs of the world's poorest, without compromising the ability to address future needs.
- Gender sensitive: A description of the good practice must show how actors, men and women, involved in the process, were able to improve their livelihoods.
- Technically feasible: Technical feasibility is the basis of a good practice. A good practice is easy to learn and to implement.
- Inherently participatory: Participatory approaches are essential as they support a joint sense of ownership of decisions and actions.
- Replicable and adaptable: A good practice should have the potential for replication and should therefore be adaptable to similar objectives in varying situations.

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- **Reducing disaster/crisis risks, if applicable:** A good practice contributes to disaster/crisis risks reduction for resilience." John F. Ryan suggests the following criteria to evaluate good practice in the health sector (Ryan, 2016):
- Effectiveness and efficiency: the degree to which the good practice was successful in producing a desired result in an optimal way. The effectiveness and efficiency criterion should measure the extent to which the objectives of quantity, quality and time have been met under real conditions at the lowest possible cost, i.e. evaluate the outcomes and/or processes.
- Equity: the practice should take into account the needs of the population (men and women) when allocating the resources and identify and reduce inequalities.
- Relevance: the practice should be applicable to political/strategic context, which needs to be clearly explained and considered.
- Intervention characteristics: the situation analysis, established objectives, a consistent methodology, etc. should be provided.
- Evidence and theory based: the good practice should make use of scientific excellence or other evidence, be analysed and disseminated in a conscious, explicit and thoughtful way.
- Ethics: the good practice should be respectful of ethical values
- Transferability: the transferability criterion should define to which extent the implementation results are systematised and documented, making it possible to transfer the good practice to other contexts/settings/countries or to scale it up to a broader target population/geographic context.
- Sustainability: the sustainability criterion should evaluate the practice's ability to be maintained in the long-term with the available resources, adapting to social, economic and environmental requirements of the context in which it is developed (Ryan, 2016).

In the media and communications industry Swart assesses and classifies good practice against the following evolutionary scale (Swart, 2011):

Stage 1. Developing – An activity, method, technique or strategy that is in concept or development and shows potential to become a best practice. Its relevancy, effectiveness and potential for replication among other organisations has not been proven yet.

Stage 2. Promising - An activity, method, technique or strategy that has worked well for one organisation and shows promise during its early stages for becoming a best practice with a long-term sustainable impact. A promising practice must have some basis for claiming effectiveness and must have the potential for replication by other organisations.

Stage 3. Good – An activity, method, technique or strategy that leads to an actual change, has an impact on a policy, demonstrates an innovative or replicable approach and sustainability.

Stage 4. Best - Activities, methods, techniques or strategies that have consistently shown results superior to those achieved with other means in a given situation and that could be adapted for other situations. Their effectiveness and ability to produce successful

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outcomes have been corroborated by the evidence provided by subjective and objective data sources

The evolution to a higher classification level is achieved when a practice meets additional criteria as improvements are made. This requires rigorous evaluation of demonstrated success and impact and a confirmed capacity for replication.

Furthermore, Swart provides a matrix for identifying where a given practice is on the evolutionary scale as an indication of the potential for that practice to be classified as "best practice." Practices placed in the lower left corner of the matrix have a lower ranking, whereas those placed in the upper right corner of the matrix are ranked highest.

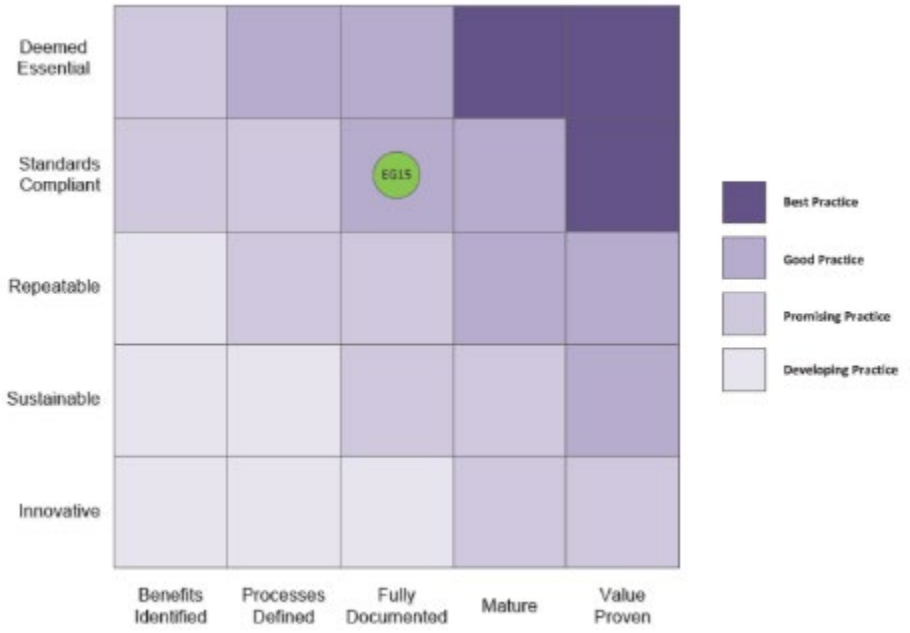

Fig.2 Best practice matrix by Swart, Sytel Reply (2011)

Additional questions relating to the criteria in the vertical and horizontal axes can also assist in the classification and assessment of practices:

Criteria	Related questions
Innovative	Is this a unique idea, does it break new ground, does it significantly enhance an existing Practice?
Sustainable	Does it require more effort than it is worth, is it dependent on an individual, does it have sponsorship, is it funded?
Repeatable	Is it restricted for any local reasons, can it be easily replicated elsewhere?
Standards Compliant	does it comply with local and/or industry standards?
Deemed Essential	Can the business do without it, has it become embedded in the business operations?

Fig.3 Vertical axis criteria by Swart, Sytel Reply (2011)

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Criteria	Related questions
Benefits Identified	What does it deliver, how is this unique, who/what does it benefit?
Process Defined	Are the processes well defined?
Fully Documented	Is it well documented, is the documentation complete and up-to-date?
Mature	How long has it been in operation, how stable is it, is it well integrated?
Value Proven	Is it expensive to implement and operate, does it require a lot of attention, what benefits has it delivered, can the benefits be financially quantified?

Fig.4 Horizontal axis criteria by Swart, Sytel Reply (2011)

Swart also proposes a scoring matrix to determine the degree of achievement of the criteria, such as the following:

Criteria	Benefits Identified	Processes Defined	Fully Documented	Mature	Value Proven
Deemed Essential	6	7	8	9	10
Standards Compliant	5	6	7	8	9
Repeatable	4	5	6	7	8
Sustainable	3	4	5	6	7
Innovative	2	3	4	5	6

Fig.5 Scoring matrix by Swart, Sytel Reply (2011)

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4. Conclusions

Having considered the good and best practice criteria suggested in diverse activity sectors, for the future study, we propose the following process and principles to determine the good practice transferability, its potential to become a best practice or standard and to assess their benefits and impact on the environment:

Stage 1. Identification and evaluation of good practice cases according to their:

A. **Relevance – the practice has demonstrated** benefits to marine pollution prevention/reduction/monitoring/quantification/removal/recycling and to good-functioning of the aquaculture sector with reference to scientific evidence and/or documented outcomes of the practice. The practice addresses the UN Sustainable Development Goals (especially SDG 2,8,9,12,14 &17) and responds to the European strategies (Green Deal, Marine and Water Directives, etc.)

B. **Effectiveness / Efficiency - the practice has demonstrated success** in producing a desired result in an optimal way. It meets the objectives of quantity, quality and time under real conditions at the lowest possible cost.

C. **Economic, social and environmental sustainability -** The practice shows the ability to be maintained in the long-term with the available resources, adapting to social, economic and environmental requirements.

D. **Collaboration/Integration capacity-** The practice adopts participatory approaches and builds effective partnerships among various organisations of the aquaculture and marine sectors and between states/territories.

E. **Transferability, replication, adaptation** - The practice demonstrates a documented potential for replication and is therefore be adaptable to similar objectives in varying situations. making it possible to transfer it to other contexts/settings/countries or to scale it up to a broader target population or a geographic context.

F. **Ethical dimension** - The practice is respectful of ethical and equity (gender, socio-economic background, etc.) values.

G. **Technical feasibility –** The practice is easy to learn and to implement.

H. **Environmental impact** – The practice reduces the negative impact of human activities on the environment and helps aquaculture operators to minimise the adverse changes to air, water, or land that their operations and processes may cause. It contributes to disaster/crisis risk reduction for resilience.

Stage 2. **Classification of good practice** against the evolutionary scale (Developing, Promising, Good and Best practice) on best practice matrix (Swart, 2011).

Stage 3. **Assessment of best practice** on the scoring matrix to determine the degree of achievement (Swart, 2011).

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The identification of good practices and replication of best practices should benefit both the marine environment and the aquaculture sector and assist it to achieve its goals of efficiency.

The evaluation process and the criteria listed here above can be adapted to fit the needs of the sector in the most effective manner. It remains up to individual enterprises to manage the change programme which will ensure the adoption of best practice in the domains where it applies best and is most feasible. It is also necessary for fast evolving sectors such as aquaculture, to review and adapt regularly their best practice to the latest technological developments, new scientific research, and current issues facing the sector.

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