AQUA-LIT

Knowledge wave on marine litter from aquaculture sources

Deliverable 2.2 (D2.2)

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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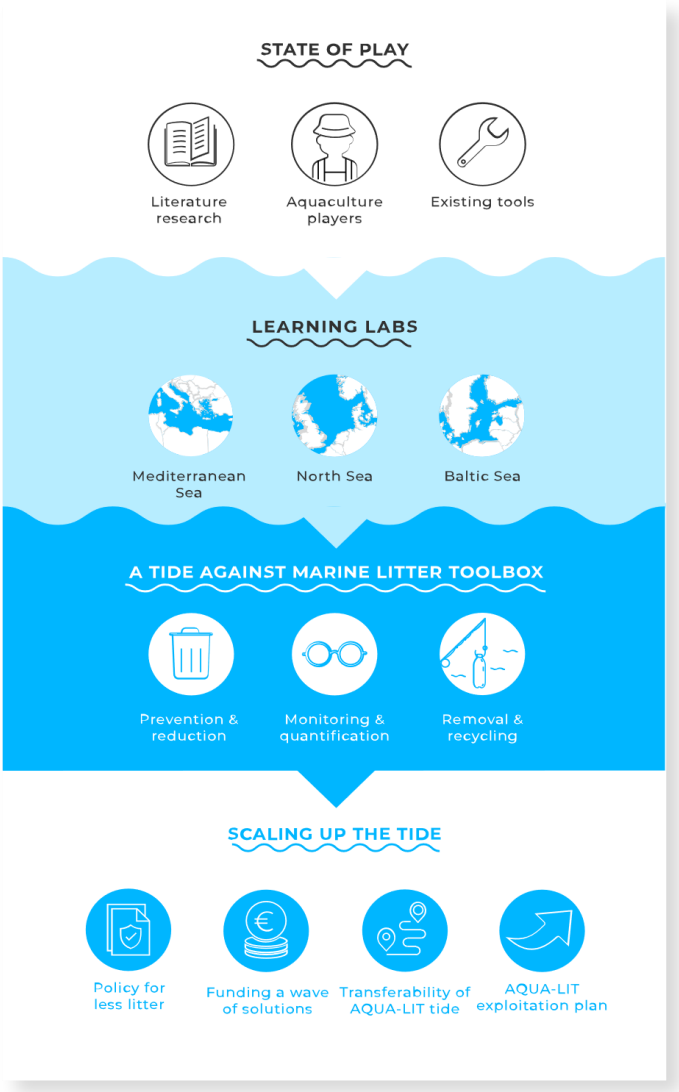
AQUA-LIT project

AQUA-LIT is an EMFF-EASME 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 fulfill 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 a potential **transformation of the aquaculture sector towards a less polluting sector** can become possible.



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Project Consortium

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Knowledge wave on marine litter from aquaculture sources (D2.2)

1. Summary

The aim of this report is to provide an overview of the available knowledge on marine litter originating from the aquaculture sector and reported in the marine environment of **the North Sea region**, **the Mediterranean region**, and **the Baltic region**.

In order to understand the potential sources of **aquaculture litter**, this report starts by providing an overview of the different types of **aquaculture facilities** in these areas. In the North Sea, aquaculture of shellfish is widespread along the coasts of most countries whereas floating cages for finfish farming are clustered in favourable areas in the outer regions of the Greater North Sea. Production of seaweed is still limited in the North Sea with France and Norway being the major producers and other countries investing in pilot facilities to explore economic feasibility. In the Baltic Sea, mariculture facilities are less diverse and abundant, with very little shellfish and seaweed facilities. The production of finfish is limited to Finland, Sweden and Denmark. In the Mediterranean Sea, aquaculture is charachterised by a much wider variety of finfish production. Also shellfish and seaweed production is present, mainly in France, Italy and Spain.

Following the mapping results of the aquaculture facilities, this report provides a description of all aquaculture related items that can be observed as litter in the marine and coastal regions. This **litter inventory** was generated by a genuine screening of the available literature and litter databases (e.g. OSPAR, HELCOM, Marine Litter Watch) and will be extended during the course of the AQUA-LIT project on the basis of discussions with stakeholders and aquaculture farmers. Currently, this list consists of 64 different items of litter, of which 19 items are unique to the aquaculture industry.

Efforts were made to quantify the marine debris from the aquaculture sector using data from scientific publications. This provided an indication of the occurrence of this category of debris at a certain location, what can be used to inform stakeholders, aquaculture industry and policymakers. **Sea basin maps** were generated visualising information on the geographic position of aquaculture facilities, in combination with the quantitative data of aquaculture-related litter. These maps are provided for the three sea basins and give an initial indication of the sources and sinks of aquaculture-related litter, which are a useful tool to inform various stakeholders and policy makers. In addition, the proportion of aquaculture related litter in relation to the total amount of litter was calculated for both beach litter, floating litter and seafloor litter in all monitoring locations. In European waters, most aquaculture related litter is made from **plastics**. In the North Sea, aquaculture debris is mainly originating from **finfish and shellfish aquaculture activities**. In the Mediterranean and Baltic Sea, primarily shellfish aquaculture related litter was collected. In many countries only shellfish aquaculture related debris was monitored and recorded, and therefore impossible to compare with other aquaculture activities. The highest percentages of the mariculture related debris were found on the seafloor (14.75%), followed by the sea surface (11.25%) and the beach (4.08%). The

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North-western Adriatic Sea and the region of Corfu island show the highest proportion of aquaculture related debris in relation to the total amount of litter.

The current needs and knowledge gaps on litter from the aquaculture sector are summarised in this report:

- There are many aquaculture activities carried out in Europe, unfortunately it is currently not possible to display all aquaculture facilities due to the **lack of data** from many countries. Most monitoring events took place in the Adriatic Sea, while in the Southern Mediterranean Sea almost no surveys were conducted. In the North Sea and Baltic Sea there is a lack of data from several countries regarding the location of aquaculture facilities and the quantification of aquaculture related debris.
- **Important farmed species** in the North Sea region are salmon, rainbow trout, mussel species, oysters and brown seaweeds. In the Baltic Sea region, mainly rainbow trout, mussels and oysters and brown seaweeds are farmed, and for the Mediterranean Sea region mussels, oysters and other clams, European seabass and a wider variety of finfish, red and green algae belong to the farmed species.
- Depending on the type of aquaculture facility, different types of waste can be expected. The '**AQUA-LIT litter inventory**' contains aquaculture items that are currently already found as marine debris and this list will be completed during the course of the AQUA-LIT project.
- Most of the litter items from the litter inventory consist of **plastic**, which certainly shows that measures need to be taken to tackle plastic litter from the aquaculture sector.
- At regional level, **monitoring programmes should be harmonised** between the regions and between the countries (e.g. HELCOM, OSPAR). Currently, different codes are used for the objects, and the units used in the reporting are also different. As a consequence, it's difficult to compare the results between countries and sea basins. Furthermore, there is no official monitoring programme for the Mediterranean Sea region, currently the data are based on citizen science initiatives.
- This report contains **maps for the North, Baltic and Mediterranean Sea regions** that for the first time ever document the presence of aquaculture debris in these areas, based on available data. The maps drawn up in this report also give an indication of the data gaps in different parts of the three sea areas.
- The monitoring programme that exists for seafloor litter (e.g. OSPAR) does not provide a category for aquaculture debris.
- There is a **need for open-access hydrodynamic models** that demonstrate the distribution of different types of litter in the North and Baltic Sea. Currently there are models that show the drift patterns of oil spills in the North and Irish Sea but the applicability of these models for marine litter is not known. These models should also distinguish different materials and forms of litter. For the Mediterranean Sea, a hydrodynamic model was developed by the INDICIT project.

This report will be combined with the ongoing exercise on the mapping of aquaculture stakeholders and the report D2.3 on 'Available tools and measures' to discuss possible solutions

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for the specific problems related to this litter in the 'Learning Labs'. In this way, work will continue on the AQUA-LIT 'Toolbox for integrated approaches'.

2. Players at play

2.1. Objectives

The topic of aquaculture litter is very diverse and complex, and seeks a thorough understanding of the wide range of actors; **individuals, groups and organisations** operating in different stages of an aquaculture farm lifecycle (Initiation, Development, Operation and Maintainance, End of Life) and at a variety of spatial and governance scales.

An initial review of relevant actors was conducted in the AQUA-LIT project with the overall aim to gain a better understanding of the various actors relevant in the context of marine aquaculture litter and advise an **effective stakeholder engagement strategy** in the project. This is also essential for the development of recommendations which will be **targeting the appropriate type of actors** with the **'policy for less litter'** set of recommendations, taking into account national, regional and sea basin dimensions.

Having a good understanding of relevant actors is not only a prerequisite for the establishment of mechanisms for attracting stakeholder input into the AQUA-LIT work, but also for effectively feeding the AQUA-LIT recommendations back into relevant policy processes, and for providing recommendations on ways to increase social awareness about the topic of marine litter from aquaculture activities. In order to ensure the acceptance and implementation of the AQUA-LIT project results and recommendations, it is crucial to have those with the power and knowledge, actively involved in the early development stages of the project.

2.2. Stakeholder categories

As a first step in the analysis of actors relevant in the context of marine aquaculture litter, a comprehensive list of actors has been compiled and categorised. Figure 1 presents the stakeholder categories through the life cycle of the aquaculture farm as defined in the AQUA-LIT project, and serves for further analysis of actors in regard to type and amount of marine litter being produced by their aquaculture related activities.

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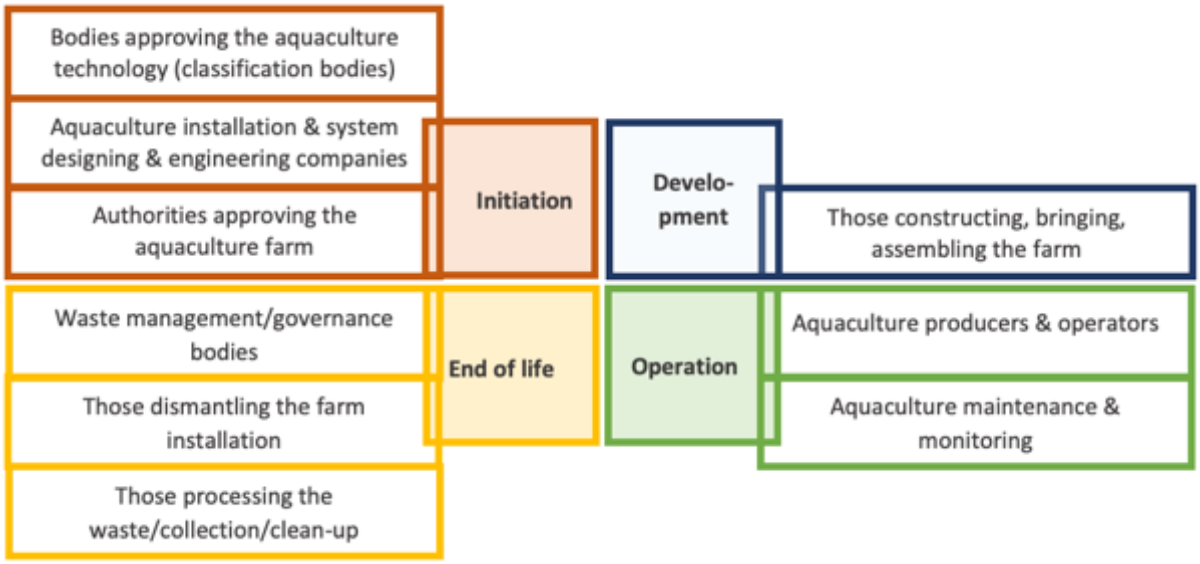

Figure 1: Stakeholder categories in regard to life cycles of an aquaculture farm.

Analysis of actors is an **ongoing iterative process** that will evolve throughout the AQUA-LIT project. Therefore, stakeholder lists and descriptions of stakeholders operating in different stages of an aquaculture farm life cycle and in different countries are summarised in internal project documents to be published at the end of the project. The information and knowledge gaps identified at this stage will be filled in during the stakeholder engagement process throughout the project. The findings from the desktop phase of the stakeholder analysis will be verified and revised through various participatory methods including interviews, webinars and workshops. As new information is gained (purposefully or opportunistically), stakeholder information will be updated and revised, with an intention to deepen the analysis.

For the purpose of this deliverable, the stakeholders active in the 'operational' stage of the aquaculture life cycle were examined and described in following section.

2.3. Aquaculture facilities

It is relevant to understand the **location, volume and type of aquaculture** facilities across the three analysed sea basins, as this may give an indication on the origin of various types of aquaculture litter. Given the different water conditions, presence of natural resources and farming traditions, different types of aquaculture can be found across the three sea basins analysed. The different mariculture facilities, the cultivated species and an indication of their volume produced are described below. A map indicating the exact location of the aquaculture facilities, as described in more general terms is presented in Figures 2, 3 and 4.

The **locations of the aquaculture facilities** in all three sea basins were retrieved from the EMODnet Human Activities database. This portal provides freely accessible and downloadable data and an interactive map of Europe on macroalgae, finfish and shellfish aquaculture.

The macroalgae dataset includes geographic data on the production facilities and the production method. With relevance to this project, data have been collected in the following countries: Belgium, Denmark, Estonia, France, Germany, Italy, Netherlands, Norway, Spain,

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Sweden, and UK. Data are missing for Poland, Latvia, Lithuania, Finland, and for most countries in the Mediterranean Sea. Data were last revised on 2018-10-09.

The marine finfish dataset includes offshore and inland facilities related to the farming of marine finfish. The database contains marine finfish aquaculture facilities in the following countries: Cyprus, Denmark, Finland, Greece, Malta, Norway, Spain and UK. Countries with missing data are France, Italy, Montenegro, Albania, Croatia, Slovenia, Germany, Poland, Estonia, Latvia, Lithuania, Sweden, Belgium and the Netherlands. Data were last revised on 2019-01-04.

The shellfish dataset provides information on the location of shellfish farms in Denmark, Greece, Ireland, Italy, Spain, UK, France and the Netherlands. Data were last revised on 2015-01-28.

Complementary to the EMODnet information, an indication of the **production volume of the different species cultivated** was obtained from the FAO production figures of 2017 (FAO, 2019). The production in tonnage is summarised in Table 1 and is used to guide the interpretation of the production of the different species groups in the different sea basins. An overestimation of the production might have occurred for those countries bordering several sea basins (e.g. the finfish production in Norway includes both the production in the greater North Sea and in the Atlantic Ocean).

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2.3.1. Finfish

The **aquaculture of finfish** shows a strong difference in selected finfish species between the studied sea basins (Figure 5). The technologies and practices used for finfish production also differ accros the sea basins, from more traditional small scale (i.e. Adriatic) to more industrial scale (i.e. North Sea). This type of aquaculture is expected to grow in the Mediterranean and North Sea countries, especially in further offshore areas (Bamlett et al., 2018).

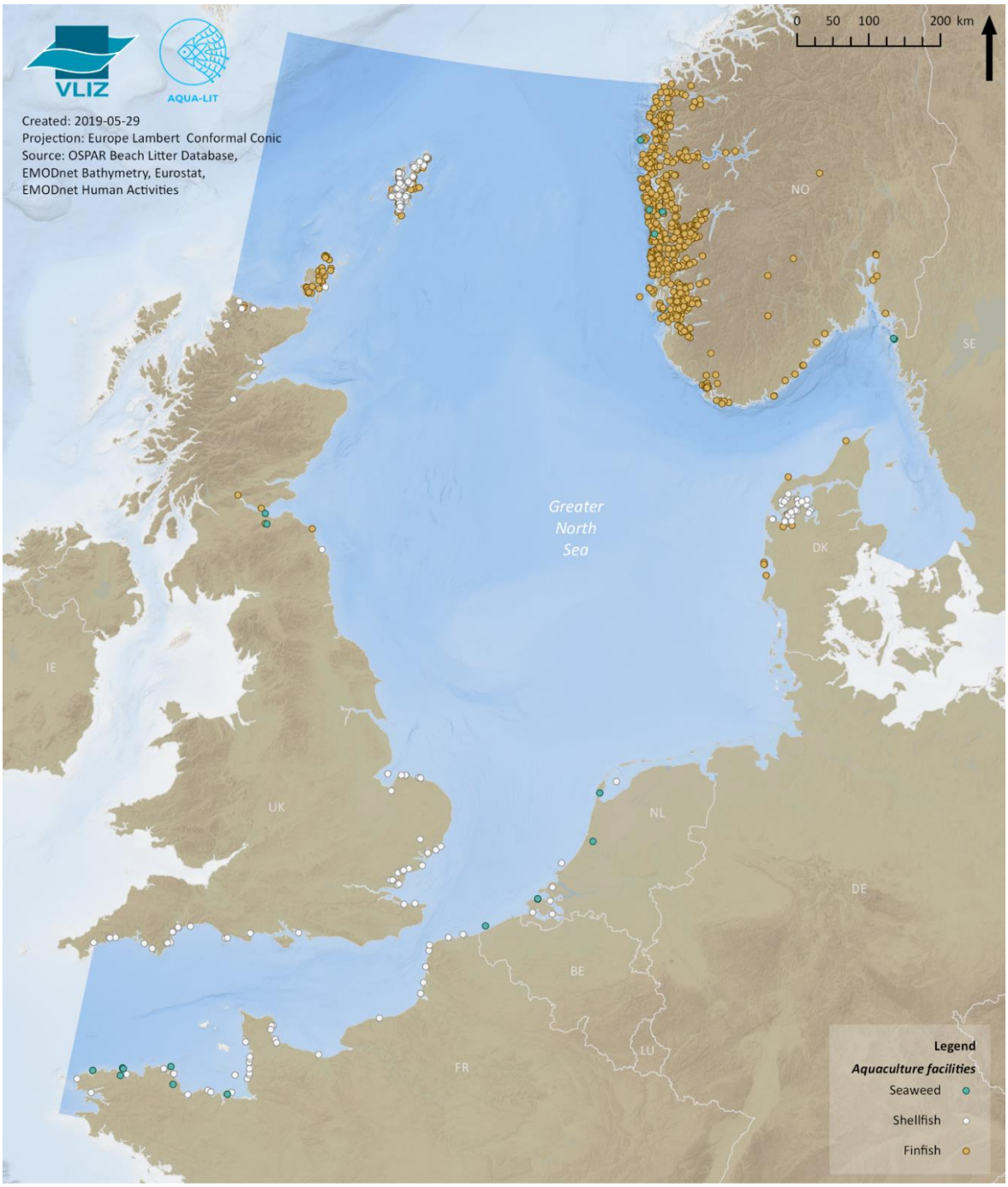

Figure 2: Distribution of aquaculture facilities for seaweed, shellfish and finfish in the Greater North Sea basin (Source: EMODnet Human Activities).

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Figure 3: Distribution of aquaculture facilities for seaweed, shellfish and finfish in the Baltic Sea basin (Source: EMODnet Human Activities).

In the North Sea, facilities are clustered in favourable areas in the outer regions of the Greater North Sea (Figure 2). Atlantic salmon (*Salmo salar*) is the most important aquaculture species in Europe that benefits from natural conditions with good sea temperatures, salinity and currents in sheltered fjords. Most of the farmed Atlantic salmon is produced in floating cages in sea, while there are a few land-based farms. Norway, followed by the UK, are the most important producing countries in Europe (European Commission, 2019). The second most important aquaculture species in this region is the rainbow trout (*Oncorhynchus mykiss*). This freshwater species can be farmed in floating cages in lakes or tanks located beside a river. However, trout are also grown in floating cages in the protected waters of the Scandinavian

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fjords. When the fish have reached commercial weight, the trout are collected with a net or are pumped on to land. Today, nearly all rainbow trout on the EU market comes from aquaculture.

In the **Baltic Sea**, on the other hand, this type of aquaculture is not so prominent given the eutrophication increase concerns. Farmed fish production in this region is more relying on recirculating aquaculture systems (RAS) on land. Rainbow trout (*Oncorhynchus mykiss*) is the most important farmed fish species in this region, which is farmed in floating cages in the low saline water of the Baltic Sea. Finland, Denmark and Sweden are the main producers in the Baltic Sea. However, since the EMODnet data doesn't have information on the activities in Sweden, finfish facilities is this region are not shown in Figure 3.

In the **Mediterranean Sea** (Figure 4), a much wider variety of finfish is farmed, of which the European seabass (*Dicentrarchus labrax*) is the main species. Most farmed European seabass are produced in floating sea cages, with a few produced on land-based farms. The fish is normally harvested after one and a half years and up to two years in size categories below 1 kg (European Commission, 2019). Gilthead seabream (*Sparus aurata*) is the second most produced species in the Mediterranean Sea. This species is normally reared in sea cages, but some land-based systems can be found. The fish is normally harvested after approximately 16 months in the sea, and, as with European seabass, in small size categories below 1 kg (European Commission, 2019). After Turkey, Greece is the largest aquaculture producer of seabass and seabream in the Mediterranean Sea, followed by Spain and Italy. Atlantic bluefin tuna (*Thunnus thynnus*) is a quotum species present in both the Mediterranean and the eastern Atlantic with a high market value. Due to the stagnation in the yield of the wild fisheries, countries are trying to exploit the quota to the fullest and raise wild-caught specimens in aquaculture conditions for the purpose of increasing fat content. Malta, Croatia and Spain are countries bordering the Mediterranean sea practicing aquaculture in the greatest volume. There has also been an intensive effort in closing the life cycle of Atlantic bluefin tuna in Europe, but this has not yet been achieved (European Commission, 2019).

2.3.2. Shellfish

The extractive aquaculture (shellfish and seaweed) sector is gaining traction across the EU, with a wide range of commercial applications going beyond human consumption (e.g. poultry and fish feed, biofuel, chemistry, pharmaceuticals, etc.) (European Commission, 2019). Various species can be cultivated by using different techniques (Figure 5).

Mussel species are a major aquaculture product in several European countries. Production of aquaculture mussels is much larger than the production by mussel fishing. The blue mussel, *Mytilus edulis*, and the Mediterranean mussel, *Mytilus galloprovincialis*, are the core of European production. According to FAO (2018), EU production amounted to 545,000 tonnes in 2015, providing approximately 27% of the world supply. Mussel production has shown remarkable fluctuations over recent years due to the decrease in the mussel production from diseases and lack of mussel seeds.

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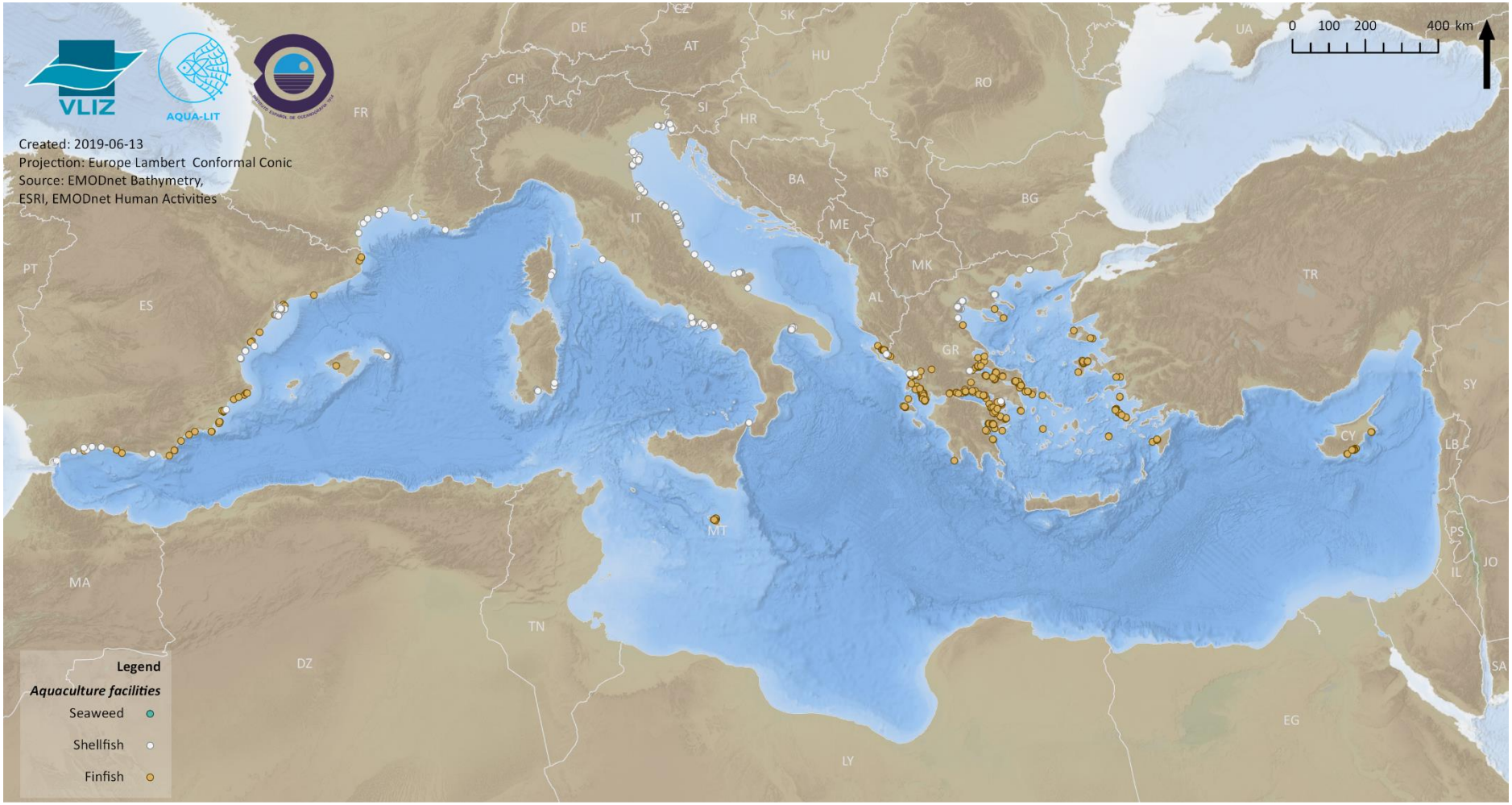

Figure 4: Distribution of aquaculture facilities for seaweed, shellfish and finfish in the Mediterranean Sea basin (Source: EMODnet Human Activities).

There are three different culture techniques for mussel farming - using poles ("bouchot"), suspended ropes or bottom culture:

- ***Pole culture***: A "bouchot" is made of wooden poles, placed upright into the intertidal area. Mussel seed or spat, collected (usually around March) either on poles (placed further out to sea) or on ropes, are transplanted onto growing poles ("boudinage") in July. A net is placed over the whole structure to keep the mussles from falling. Harvesting occurs after 15 months of growth by manual or mechanical scraping.
- ***Suspended rope culture***: For this technique, ropes covered with mussel seed are suspended either from metallic frames or from floating structures, enabling young mussels to remain under water permanently. Frames are built from metallic poles, placed upright into the ground, at water depths ranging between three to nine metres. Young mussels, placed in nylon net-bags, are grown throughout the year and harvested according to demand. Floating structures are rafts ("bateas"), saucers or longlines. This technique is suitable for sheltered areas (Mediterranean Sea). Offshore mussel farming, which recently developed in France, the UK, and Belgium, also uses this technique. The mussels are harvested by raising the ropes out of the water and removing the clusters.
- ***Bottom culture***: This technique rests upon the harvesting of naturally produced young mussels and their spreading out on specially prepared growing plots. This technique is widely practised in the Netherlands.

In the **North Sea**, mussel cultivation (predominantly blue mussel) is dominated by France and the Netherlands. Other smaller producers of the blue mussel are Denmark, Norway, Sweden and the UK. The locations of the shellfish facilities in Norway and Sweden are not present in the EMODnet Human Activities database and hence not shown on Figure 2.

Multiple mussel farms can be identified along the **Baltic coast**. Nevertheless, except the sites in the Western Baltic Sea, mussel farming is mainly in the experimental scale in the Baltic Sea Region. Demonstration projects are currently running to explore full scale mussel farming in the Baltic Sea (more specifically along the German, Danish, Latvian and Lithuanian coast). Cultivating and harvesting blue mussels in the Baltic Sea may substantially improve the water quality and transparency as mussels filter water and take up nutrients through their food intake, thus counteracting eutrophication (Baltic Blue Growth project, 2017; Ozolina et al., 2017). In the Baltic Sea, SUBMARINER Network has a crucial role in gathering relevant actors including public authorities, research centers and industry to jointly work on innovative mussel projects in the region. Apart from the Baltic Blue Growth project, focusing directly on the suitability of mussels cultivation in the Baltic Sea Region, the SUBMARINER Network members are also working on a highly innovative InnoAquaTech project in the South Baltic. This project is working to develop and transfer innovative and sustainable aquaculture technologies across the area. Through this project, SMEs all over the region are getting access to state-of-the-art technology, know-how, expertise and financing models.

In the **Mediterranean Sea**, France, Italy and Spain are the main producers of the Mediterranean mussel. Slovenia, Turkey, Greece, Croatia, Albania and Montenegro contribute to a lesser extent to the mussel production in this region (European Commission, 2019).

Figure 5: Examples of European marine aquaculture farms. The collage above depicts several types of aquaculture performed in the North Sea, Baltic Sea and Mediterranean Sea. Nevertheless, aquaculture types can differ per region and country. Besides this, various shellfish farming techniques can be used for the cultivation of multiple shellfish species. A) Net cages for cultivation of seabass; B) Net cages for cultivation of seabream; C) Net cages for cultivation of Atlantic salmon; D) Pole culture for mussel cultivation; E) Bottom culture for oyster cultivation; F) Bottom culture for clams farming; G) Suspended rope culture for mussel cultivation; and H) Suspended rope seaweed farm (Sources: s.Pro, CNC France, GAA and European Commission).

Oyster farming has a long history. After several years of decreasing production caused by the 2008 disease outbreak in French oyster farming areas, production has increased again since 2014 (European Commission, 2019). In Europe, commonly farmed oysters include the European flat oyster, *Ostrea edulis*, and the Pacific cupped oyster, *Crassostrea gigas*. According to the European Mollusc Producers Association (EMPA), the EU production of oysters in 2015 was 108,910 tonnes and contributed for 97.5 % by Pacific cupped oysters and for 2.5 % by flat oysters. The Portuguese cupped oyster (*Crassostrea angulata*) (also called the "Japanese oyster" in Europe) is not cultured commercially in Europe anymore (European Commission, 2019).

The sector is characterized by being composed mainly of small, family-owned businesses of limited financial capacity. European oyster-growing techniques have developed in order to supply the market for fresh oysters, delivered in the shell. Cultivation is usually a three-year process that starts with the collection of small oysters on a support from which they can be

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easily removed after six to eight months. During the second year of culture, oysters are spread out in the intertidal range, either directly on the ground (bottom culture), or in bags on trestles, or suspended (Mediterranean shores). Half of the spat used for oyster farming is supplied by hatcheries; the remaining 50% is wild spat collected by farmers (European Commission, 2019).

In the **Baltic Sea**, oyster farming is not successful due to the low saline waters. In Sweden, this relatively new industry is still in its research phase; investigating the high mortality rates observed in Swedisch commercial hatcheries (Cordis, 2019). In the **North Sea**, oyster culture is dominated by France, while the Netherlands and the UK have limited production capacity. In the **Mediterranean Sea**, the oyster farming countries are France, Spain, Italy, Croatia and Malta.

Bivalve molluscs (including clams which is a common name for several kinds of bivalve molluscs) are available from both fisheries and aquaculture. According to European Commission, 2019, EU production of clams from aquaculture accounted for 44,000 tonnes in 2016. The main species produced are grooved carpet shell (*Ruditapes decussatus*), Pullet carpet shell (*Venerupis pullastra*), Japanese carpet shell (*Ruditapes philippinarum*) and cockles (*Cerastoderma edule*).

In the **Baltic Sea**, the aquaculture production of this type of bivalve molluscs is absent. In the **North Sea**, France is the main aquaculture producer of clams. In the **Mediterranean Sea**, the majority of farmed clams come from Italy, and other clam farming countries are France, Spain and Slovenia.

2.3.3. Seaweed

Marine macroalgae, or seaweeds, are traditionally harvested for the extractrion of hydrocolloid for industrial purposes. EU macroalgae production is limited but the demand for edible algae is increasing in EU markets, and new production models and new market stream are emerging (European Commission, 2019). Macroalgae production is an upcoming sector for growing biomass for producing food, pharmaceuticals, consumables such as plastics and energy without competing for arable land, depleting fresh water and using non-renewable fertiliser.

The most important species, in terms of landings and value, are *Laminaria digitata*, *Laminaria hyperborea* and species *Ascophyllum nodosum*, because these species are harvested mechanically by fishing vessel in France and Norway. *Ascophyllum nodosum* is harvested by fishing vessel in Norway, whereas in France and Ireland, it is harvested manually. All other species are harvested manually, either on foot or by diving. Mechanical harvesting is done by fishing vessels and is practised mainly in Norway (Rogaland to Sør-Trøndelag), France (Brittany), Spain (Galicia and Asturias) and to a lesser degree in the French Basque Country and Ireland (European Commission, 2019).

EU algae production increased from 2005 to 2014 with 67%, with a production to more than 93,000 tonnes in 2014 (0.3% of the world supply). In the **Baltic Sea**, Denmark is the largest producer of seaweed (Table 1). Besides that, the SUBMARINER Network has a crucial role in gathering relevant actors, and initiating innnovative projects in the field of sustainable seaweed and mussels aquaculture. For example, an EU funded project, GRASS is working on pilots in the Baltic Sea to raise the awareness and build capacity on macroalgae cultivation, harvesting and use among public authorities and other relevant stakeholders across the region. Public

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authorities, ministries, planning regions and counties play a crucial role in promoting macroalgae as they are the main legislative bodies that also control much of national and regional funding. The Department of Seaweed is a transdisciplinary platform which gathers together experts from different fields who work with seaweed as material to jointly explore seaweed as a sustainable resource.

In the **North Sea**, seaweed aquaculture is predominant in France and Norway (brown seaweeds). The majority of the production in France is wild seaweed that is harvested. Other countries (the Netherlands, Belgium) are investing in pilot studies. The Value@Sea project was initiated in Belgium in 2017 to test the technical, ecological and economic feasibility of the integrated cultivation of extractive aquaculture species such as the flat oyster, scallop and sugar kelp (Bossier et al., 2018). Zeewaar is the first seaweed farm of the Netherlands and the North sea Farm Foundation is the national seaweed platform that aims at realising a sustainable seaweed industry in the Netherlands and surrounding EU countries (Noordzeeboerderij, 2019). In the **Mediterranean Sea**, Spain (mostly red algae) and Italy (green and red algae) are the main producers (European Commission, 2019).

2.3.4. Other aquaculture types

2.3.4.1. Integrated Multi-Trophic Aquaculture

The Integrated Multi-Trophic Aquaculture (IMTA), where multi-trophic refers to the explicit incorporation of species from different trophic positions or nutritional levels in the same system, has been gaining the attention especially as a mitigation approach against the excess nutrients/organic matter generated by intensive aquaculture activities. The IMTA has many benefits, among which bioremediation is one of the most relevant (Soto, 2009; Buck et al., 2018) – this type of aquaculture provides an opportunity to reduce environmental impacts through direct uptake of dissolved nutrients, while at the same time increasing cost-efficiencies due to more products which can be sold (Schultz-Zehden and Matczak, 2012).

So far, however, hardly any real data or practical knowledge is available as only a few pilots exist (e.g. in Finland, Denmark), where mussel or macroalgae cultivations are combined with open net cage fish farms. Up to date, the EMODnet Human Activities portal does not indicate the IMTA's separately. Hence, the figures in this report do not make a distinction between single species aquaculture and the combined farming of multiple species.

2.3.4.2. Multi-use concepts with integrated aquaculture facilities

Aquaculture can be combined with other offshore uses, like wind farms or tourism. In this respect, a few pilot studies are running to investigate various aspects of offshore multi-uses. A few examples are the EDULIS project in Belgium, investigating the feasibility of mussel culture in offshore wind farms and the

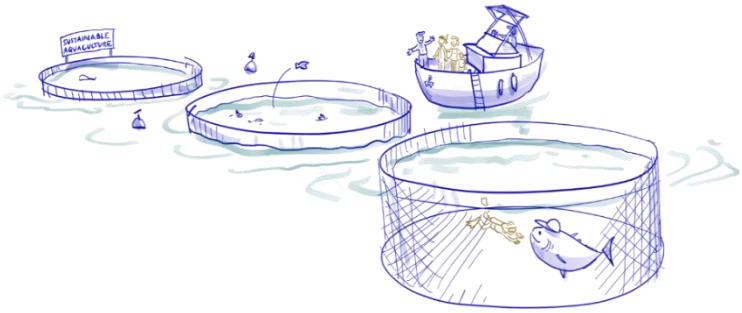

Figure 6: Tourism and aquaculture as a multi-use concept (Source: Bamlett et al., 2018).

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SOMOS project in the Netherlands, aiming to develop a meaningful safety assessment and safety control to stimulate the production of energy (wind farms) and food (seaweed) at sea.

The Horizon 2020 EU wide project MUSES (Multi-Use in European Seas) has among other extensively explored various aquaculture multi-use options and provided an overview or examples and development options in its Ocean Multi-Use Action Plan. The upcoming Horizon 2020 UNITED project is to pilot oyster farming in the offshore wind farm in Belgium, and test different options for seaweed and mussels farming combined with energy generation in the Netherlands and Germany (no source available yet - project starts in January 2020).

Moreover, tourism and aquaculture as a multi-use concept is very popular in the Mediterranean countries. For example, in the Catalunia and Murcia regions in Spain, a unique and innovative system has been developed to farm bluefin tuna. The fish are caught in the waters surrounding the Balearic Islands and then moved to an aquaculture facility where they are fattened for around a year in large offshore cages. This aquaculture operation is also being used as a tourist attraction, more specifically, to offer the opportunity to swim with the tuna in the open ocean cages (European MSP Platform). Educational elements (relating the history, biology and fishing of bluefin tuna during the boat trip to the farm) are combined with the real experience of swimming or diving and selling tuna products. Ocean multi-use that involves aquaculture has been indicated as a future trend that has yet unknown effects on marine littering.

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Table 1: **Aquaculture production in 2017, presented by sea basin and by species groups.** The countries contributing to the aquaculture production are ranked according to contribution (highest contribution is ranked first) (source: FAO, 2019).

	Sea basin	Group	Main species	Countries	Tonnage
Finfish	Baltic Sea	**Salmons, trouts, smelts**	*Oncorhynchus mykiss, Coregonus lavaretus, O. kisutch, Salmo trutta*	FI, DK, SE	21,759
	North Sea	**Salmons, trouts, smelts**	*Salmo salar, Oncorhynchus mykiss, Salvelinus alpinus*	NO, UK, DK, FR	1,503,622
	Mediterranean Sea	**Misc. coastal fish**	*Dicentrarchus labrax, Sparus aurata, Argyrosomus regius, Pagrus pagrus, Mugil cephalus*	TR, EL, ES, IT, HR, CY, AL, MT, FR, ME, SL	337,233
		Tunas, bonitos, billfishes	*Thunnus thynnus*	MT, HR, ES, TR	7,393
		Salmons, trouts, smelts	*Oncorhynchus mykiss, Salmo spp, Anguilla anguilla*	TR, IT, EL	6,252
		Other	Osteichthyes, Seriola dumerili, Solea solea	EL, MT, IT, ES	231
Shellfish	Baltic Sea	**Mussels**	*Mytilus edulis*	DE, DK, SE	20,077
		Oysters	*Ostrea edulis, Crassostrea gigas, Crasostrea spp*	FR, NL, UK, DE	66,547
		Mussels	*Mytilus edulis*	NL, FR, UK, NO, DK, SE	120,016
		Clams, cockles, arkshells	Clams nei, *Cerastoderma edule, Ruditapes philippinarum*	FR	90
	Mediterranean Sea	**Oysters**	*Ostrea edulis, Crassostrea giga*	FR, ES, IT, CR , MT	4,619
		Mussels	*Mytilus galloprovincialis*	IT, EL, FR, ES, HR, SL, TR, AL, ME	101,676
		Clams, cockles, arkshells	Clams nei, *Cerastoderma edule, Ruditapes philippinarum, Ruditapes decussatus, Ensis ensis*	IT, FR, ES, SL	36,642
Seaweed	Baltic Sea	**Brown seaweeds**	Phaeophyceae	DK	10
	North sea	**Brown seaweeds**	*Alaria esculenta, Saccharina latissima*	NO	149

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3. Aquaculture related debris

3.1. Objectives

The aim of this section is to set up a **solid knowledge base** on marine litter from aquaculture activities. This dataset includes information on the **main types of debris** (see 3.2. Identification of aquaculture related debris), as well as on the **quantities** in which they occur in the marine environment (see 3.3. Quantification of aquaculture related debris). Within this task, several geographical maps are created that visualise the regional waste problems and knowledge gaps. A structured dataset is developed to create some consistency across the divergent data in order to enable comparison and analysis between different countries and sea basins. The template of the dataset can serve as an example for future monitoring activities and data processing.

3.2. Identification of aquaculture related debris

3.2.1. Methodology

The first step in acquiring this knowledge base was carried out by drafting a list of possible litter items from the aquaculture sector found in the North Sea, the Baltic Sea and the Mediterranean Sea basins. As a starting point, several existing litter **monitoring guidelines** or **aquaculture/litter reports** were consulted, e.g.:

- The **OSPAR Beach Litter Monitoring Guidelines** include a standardized approach to collect marine litter data on reference beaches in the OSPAR Maritime Area. The OSPAR Beach Litter Database (OSPAR Commission, 2019a) is an online database that has been developed to manage the data and allow it to be interrogated at the regional, subregional and beach level (Guideline for monitoring marine litter on the beaches in the OSPAR maritime area, 2010);

- The **GESAMP reports** from the Joint Group of Experts on the Scientific Aspects on Marine Environmental Protection, e.g. Sources, Fate and Effects of Microplastics in the Marine Environment (Kershaw, 2015; Kershaw and Rochman, 2016; Kershaw et al., 2019);

- **Joint Research Centre (JRC) Technical Reports**, e.g. Top Marine Beach Litter Items in Europe from the MSFD Technical Group on Marine Litter (Veiga et al., 2016; Addamo et al., 2017);

- The **National MSFD (second cycle) contributions** (European Environment Agency, 2019);

- The **Food and Agriculture Organization of the United Nations (FAO) reports** on aquaculture and/or marine litter (Macfadyen et al., 2009; Cardia and Lovatelli, 2015; Lusher et al., 2017);

- The **Environmental Impact Assessments (EIAs)** for the aquaculture sector (if publicly available or supplied by the AQUA-LIT project partners).

Additional to these reports, the knowledge base or the **'litter inventory'** was further extended by other **scientific literature** (books and peer-reviewed publications) derived from an extensive *Web of Knowledge* and *Scopus* search. For this literature search, the search terms 'aquaculture', 'fish farm*' and 'mariculture' were combined with 'litter', 'debris', 'plastic', 'waste' and 'waste management' over a **period of 10 years** (2009 - January 2019) in relation to the **three sea basins**

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and their regional seas and waters (e.g. Gulf of Riga, Adriatic Sea, etc.). As this *Scopus* search only gave a limited number of relevant hits, an additional search was carried out on the basis of beach debris/litter in the desired regions. The full-text of each publication was subsequently screened for 'aquaculture' information.

Based on the reports, books, and publications, a list was drawn up containing both **general objects (A)** which are used by multiple offshore sectors, and **specific objects (B)** which can only be linked to the aquaculture sector. This litter inventory is equipped with a photo guide for visual clarification. All items in the list are also provided with a source reference. The publications, books and reports used are included in the online searchable catalogue which is part of the Integrated Marine Information Source (IMIS), hosted at the VLIZ website.

Additional to these reported items, first steps were taken to screen modern aquaculture techniques in the North Sea, the Baltic Sea and the Mediterranean Sea in order to identify **'other potential items' (C)** that could be found in the marine environment. For the North Sea area this was done by VLIZ. For the other sea basins, input was requested from the project partners (e.g. s.PRO for the Baltic Sea and EurOcean & IEO for the Mediterranean Sea). In addition, information is gathered from the existing and well-structured networks of all AQUA-LIT partners. Furthermore, various stakeholders active at different stages of the life cycle of an aquaculture farm, will be interviewed through a standardized questionnaire during the course of the AQUA-LIT project. Therefore, the litter inventory will be a useful instrument to identify aquaculture related debris from all mariculture sectors.

3.2.2. Results

Since the litter inventory (Annex 1) has the aim to build a solid knowledge base on marine litter from aquaculture activities, each litter item is clarified by a number of characteristics. These include an item number (A – General items, B – Specific items, and C – Other potential items), item type, item name, short description, type of material, aquaculture type, cultivated species, a picture and the literature source. The category 'item type' consists of multiple groups of items, e.g. tags, nets, ropes, collecting material, strapping material, floats, buoys, etc. The type of material is confined to plastic, metal, concrete, steel, rubber, wood, and natural textile. Since most 'general items' (A) cannot be specifically linked to certain aquaculture activities, the categories 'aquaculture type' and 'aquaculture species' are only defined for the 'specific items' (B). The information provided by the litter inventory is mainly derived from the above mentioned reports, with some additions from scientific publications.

The litter inventory mainly contains general litter items (A) (31 items, of which 22 are made of plastic), used by offshore activities including aquaculture. In addition, 19 items listed are exclusively linked to the aquaculture sector. Examples are: plastic mesh screens, mussel socks and tahitians. Almost all (18/19) specific items (B) are **made of plastic**, which indicates the importance of plastic for the aquaculture sector. **Mainly bivalve farming** is dependent on different types of plastic items (13 items) followed by the finfish industries (6 items). For seaweed cultivation only longlines are reported as litter item. The litter inventory also provides an overview of 14 items that have not yet been reported as litter, but which can get lost during aquaculture activities. Almost all litter items can be associated with the developmental and operational phase of the life cycle of an aquaculture farm.

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3.3. Quantification of aquaculture related debris

3.3.1. OSPAR, HELCOM and Marine LitterWatch beach litter databases

3.3.1.1. Methodology

The aim of this search is not only to collect information on the litter items derived from mariculture activities, but also to quantify their abundance in the marine environment. As a starting point, databases of European Regional Sea Conventions, such as **OSPAR (North Sea)**, **HELCOM (Baltic Sea)** and **Marine LitterWatch** of the European Environment Agency (EEA) (European waters, but here only used for the **Mediterranean Sea**), were consulted to map information on several specific items which were collected during beach surveys. These items include fish tags, oyster nets or mussel bags, oyster trays and plastic sheeting from mussel culture (Tahitians). An important note here is that aquaculture items are not always distinguished, and therefore some items may end up under the category 'other plastics', which is not included in the litter inventory. In addition, HELCOM does not always use the same coding method, which makes it not only difficult to compare the data within the Baltic Sea but also with the North Sea and Mediterranean Sea.

- OSPAR Beach Litter Database

The OSPAR Beach Litter Database (OSPAR Commission, 2019a) can be consulted online by every stakeholder. The OSPAR Beach Litter Dataset (OSPAR Commission, 2019b) was consulted in cooperation with the Royal Belgian Institute of Natural Sciences (RBINS). The OSPAR Beach Litter Guidelines include **four specific litter categories** linked to the aquaculture sector: No. 114 'lobster and fish tags' [G43], No. 28 'oyster nets or mussel bags including plastic stoppers' [G45], No. 29 'Oyster trays (round from oyster cultures)' [G46] and No. 30 'plastic sheeting from mussel culture (Tahitians)' [G47]. Using the OSPAR database, the data from beaches in the Northern and Southern North Sea (Figure 7: area 1 and 3) were screened on items from these four aquaculture related categories. For each survey site in these regions, the occurrence of these four **objects per 100 meters of beach** was checked and an average was calculated for the period 2009-2019.

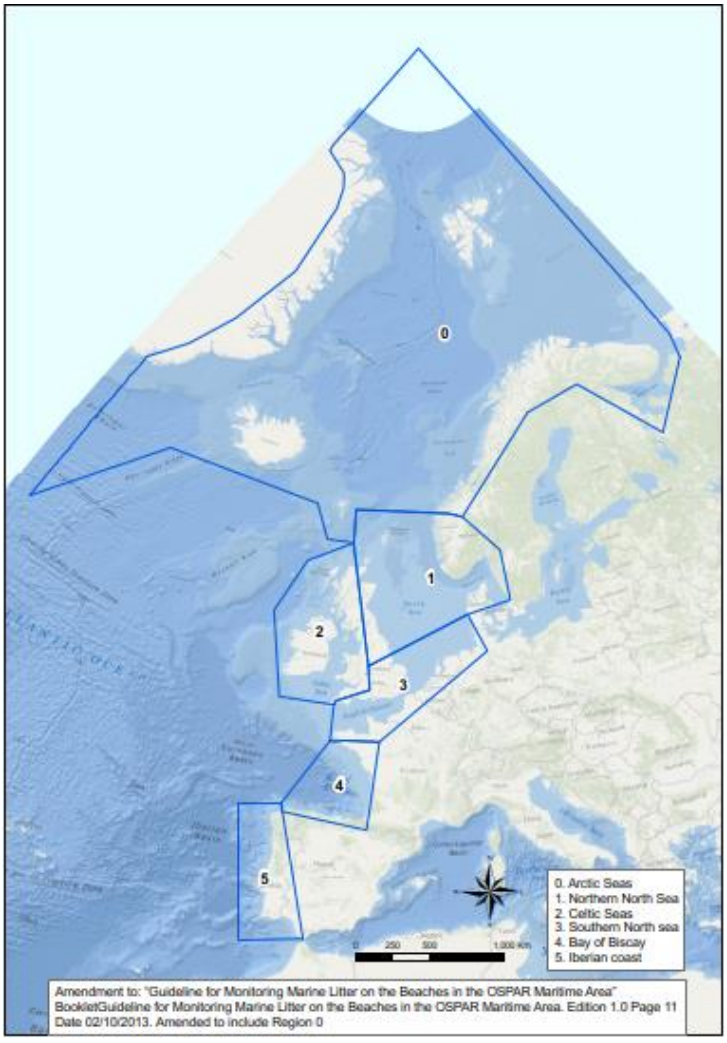

Figure 7: Map with the sea areas included in the OSPAR Maritime Area (Source: Guideline for monitoring marine litter on the beaches in the OSPAR Maritime Area).

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❖ HELCOM Beach Litter Database

The HELCOM data portal was consulted for the preparation of the map showing the presence of marine litter from aquaculture, and the locations of aquaculture facilities in the Baltic Sea. Thus, the dataset consists of the reported beach litter items on monitoring sites at the Baltic Sea area. Visualised data include the number of recovered items per category for each monitoring site, as an average for the whole monitoring period (2011-2018). Litter data is provided by HELCOM contracting parties in response to the data call for State of the Baltic sea report. For this report, the data on the same litter categories/items (fish tags [G43], mussel and oyster nets [G45], oyster trays [G46] and plastic sheeting from mussel culture [G47]) has been used as in other sea basins as to consistently compare the aquaculture litter. It is to be noted that for Estonia and Poland no data was available on the length of the monitored transect (presumably 100 m) and that surveys were probably carried out between 2011-2018 but no exact dates were registered. In Latvia, monitoring is carried out only in the summer season and is not completely comparable with other countries that carry out monitoring seasonally. Therefore Latvian data is not visualised in Figure 9. For Finland and Sweden, the length of the monitored beaches is different for each survey. In order to combine all HELCOM data, the litter data from Finland and Sweden has been converted, by Dr. Sanna Suikkanen of the Finnish Environment Institute, to items found per 100 m. Lastly, it is to be noted that for Estonia, Finland, Germany and Sweden a different coding method was used. As a consequence, only the category 'mussel and oyster nets' [G45] could be used for Estonia, Finland and Sweden, and only the category 'plastic sheeting from mussel culture' [G47] was recorded in Germany.

❖ Marine LitterWatch Database

The Marine LitterWatch platform was developed by the European Environmental Agency (EEA) as a mobile app for citizens to identify marine litter found in European seas and coasts. The information provided to Marine LitterWatch encloses the results of organized beach clean-ups, events or monitoring activities. For each event, the length of the beach is recorded as well as a description of the beach location and beach type. In addition, the transect information for the start and finish of the surveyed area is delivered. Finally, the number of items for each category is recorded. Users of the mobile app are able to identify marine litter using a European harmonized list of items reflecting similar language established by the Marine Strategy Framework Directive. Again there are four categories considered as the result of aquaculture activities: 'tags (fishing and industry)' [G43]; 'mussel nets, oyster nets' [G45]; 'oyster trays (round from oyster cultures)' [G46]; 'plastic sheeting from mussel culture (Tahitians)' [G47]. The list of data collected (Annex 4) is the result of identified items spanning from January 2013 to February 2019. The results of this program are freely available through the EEA database and exclusively used in this project for the Mediterranean Sea basin. Since OSPAR and HELCOM provide more professional databases for the North Sea and the Baltic Sea, the Marine LitterWatch database was not consulted for these basins in this project.

3.3.1.2. Results

The collected results from these three different databases (OSPAR, HELCOM and Marine LitterWatch) were recalculated per category to average number of collected items per 100 meter beach, and are visualised on three regional maps representing the North Sea, Baltic Sea and Mediterranean Sea basins (Figures 8, 9 and 10).

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❖ OSPAR Beach Litter Database

For the North Sea basin, the OSPAR data (Annex 2) is visualised with data on aquaculture facilities retrieved from the EMODnet Human Activities database (Figure 8). These datasets consist of both European seaweed, shellfish and finfish producers, and enable us to visualise the stranded aquaculture debris together with its potential sources.

The composition of the collected aquaculture related debris, **varies strongly between the Northern and Southern Greater North Sea**, as can be seen in Figure 7. Whereas shellfish aquaculture facilities (n=183) and debris related to these activities are mainly found in the English Channel and Southern North Sea, finfish facilities (n=250) and debris are primarily located and recovered in the Northern North Sea, Skagerrak and Kattegat. This not only proves that the distribution of aquaculture facilities and litter differ greatly within the Greater North Sea, but also indicates that they may be related to each other. Remarkably, the aquaculture related litter at the west coast of Sweden mainly consists of fish or lobster tags. According to Blidberg et al. 2015, this would be due to strong currents from the Atlantic Ocean towards these regions, together with frequent westerly winds. The aquaculture related litter on the Belgian, Dutch and German beaches are mainly derived from **the 'Bouchet' mussel and oyster cultivations** in Normandy, France. Another major part is originating from longline mussel cultures near Zuydcoote, France. It is noteworthy that on the beaches of the United Kingdom, none of these items were found in the period of 2009-2018. Besides this, lobster tags are not originating from aquaculture activities and fish tags can also be derived from fisheries research. Since, OSPAR doesn't make a distinction between lobster and fish tags, it is impossible to calculate the actual share of the aquaculture sector to the distribution of fish tags waste.

❖ HELCOM Beach Litter Database

In order to visualise the geographical distribution of aquaculture facilities and aquaculture related debris in the Baltic Sea (Figure 9), the HELCOM Beach Litter Database (Annex 3) and the EMODnet Human Activities database were consulted. The results show a higher occurrence of aquaculture related litter in the Southern Baltic Sea than in the Northern Baltic Sea. Nevertheless, for Estonia, Finland, Germany and Sweden a different coding method was used (see 3.3.1.1 Methodology, section 'HELCOM Beach Litter Database'). As a consequence, only the results of the category 'Bivalve net or bag' are shown for the Northern Baltic Sea. Therefore it is difficult to compare the northern part with the southern part of the Baltic Sea.

Nevertheless, one can conclude that all finfish facilities (n=174) are located around Finland (n=140) and the east coast of Denmark (n=34). In total, Denmark has 53 finfish farms in the Baltic and North Sea. Swedish finfish facilities are not included in the EMODnet Human Activities database, but are present in the FAO data (Table 1). Shellfish facilities (n=12) are mainly located at the east coast of Sweden and Denmark, and seaweed aquaculture (n=10) is primairily performed in Denmark and the Saaremaa Island in Estonia. Seaweed and shellfish aquaculture are less common in the Baltic Sea compared to the North Sea and Mediterranean Sea. Consequently, **the reported numbers of litter coming from these activities are also much lower** than in the North Sea. An exception to this trend is Lithuania where large quantities of oyster trays were collected on four beaches from January 2012 till November 2013. However, no shellfish activities have been recorded in Lithuania or its neighbouring countries. In Poland, where all categories were monitored, suprisingly only fish tags were recovered at all 15 monitoring sites. Finally, Figure 9 indicates that the number of performed surveys is quite high,

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but that the distribution is rather low with a few hotspots in the Southern and Eastern Baltic Sea.

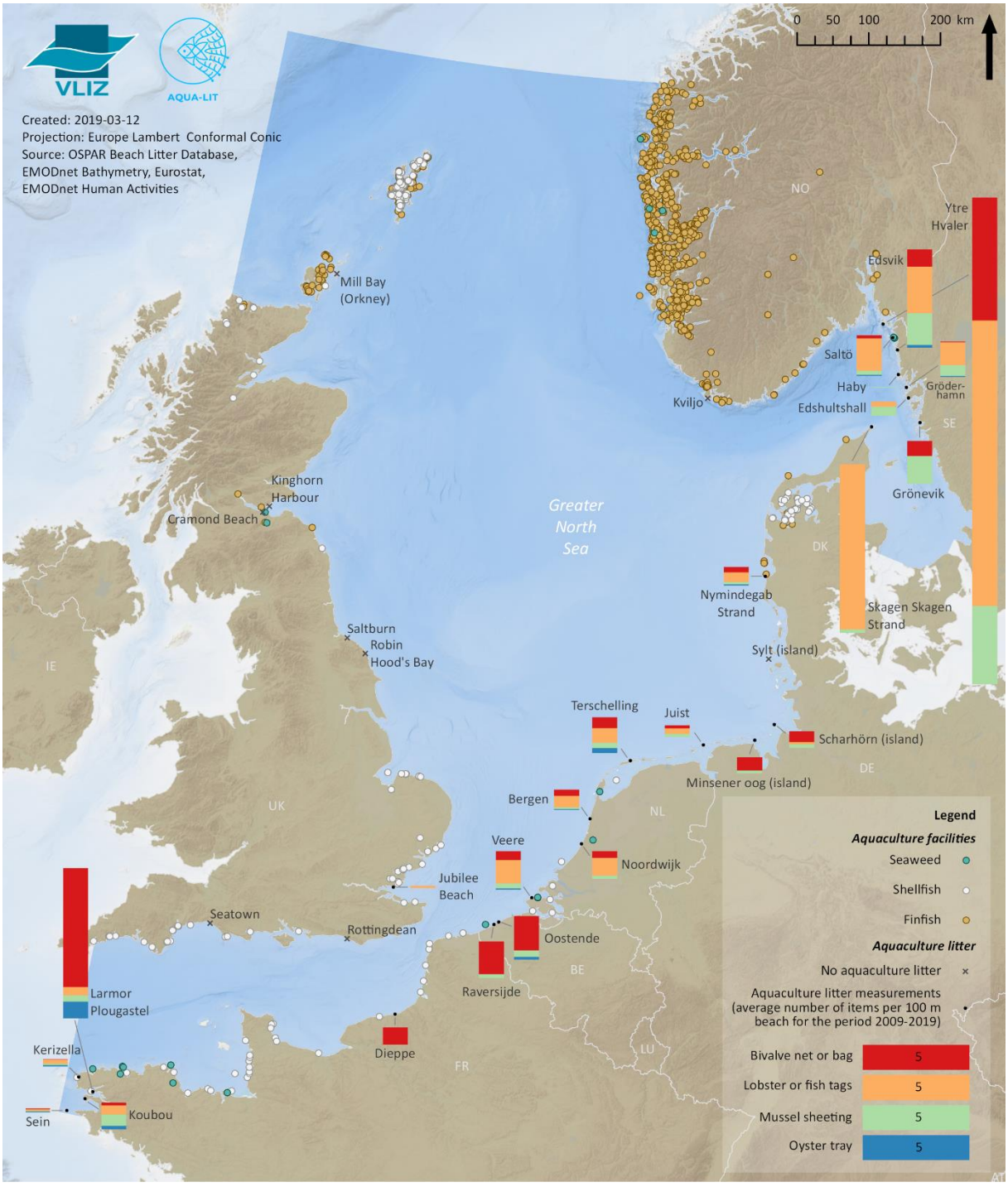

Figure 8: Distribution of aquaculture facilities and aquaculture related beach litter in the Greater North Sea basin (Source: OSPAR Beach Litter Database via Francis Kerckhof, RBINS and EMODnet Human Activities).

❖ Marine LitterWatch Database

For the Mediterranean Sea, the Marine LitterWatch data (Annex 4) is combined with data on aquaculture facilities retrieved from the EMODnet Human Activities database. Data on coastal aquaculture litter were visualised from the Marine LitterWatch database, which contains long-term data on marine debris present on European beaches.

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Figure 9: **Distribution of aquaculture facilities and aquaculture related beach litter in the Baltic Sea basin.** In order to interpret the map above correctly, it should be noted that for Estonia and Poland no data was available on the length of the monitored transect (presumably 100 m) and that surveys were probably carried out between 2011-2018 but no exact dates were registered. In addition, the data for Estonia, Finland, Germany and Sweden was collected using a different coding method. As a consequence, only the category 'mussel and oyster nets' [G45] for Estonia, Finland and Sweden, and the category 'plastic sheeting from mussel culture' [G47] for Germany were included in Figure 9 (Source: HELCOM Beach Litter Database and EMODnet Human Activities).

The two principal types of aquaculture farming at sea in the Mediterranean Sea consist of finfish farming (n=375) and shellfish farming (n=311) (Figure 10). Finfish farming is mostly found in Spain and the Aegean Sea in the countries of Greece, Malta, Cyprus and Turkey. Shellfish on the other hand is more concentrated on the Western Mediterranean Sea along the coastline of Spain, France, Italy and Greece.

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In Figure 10, the average number of collected items per 100 m using the categories: 'tags (fishing and industry)' (G43); 'mussel nets, oyster nets' (G45); 'oyster trays (round from oyster cultures)' (G46); 'plastic sheeting from mussel culture (Tahitians)' (G47). In general, **bivalve nets and bags were mainly found in neighbouring regions of countries with high shellfish farming activity**. This may give an indication of the potential source of the mussel nets found on these beaches. The second most commonly found item were fish tags. Interestingly, fish tags were most frequently found on Italian beaches and beaches along the Adriatic sea where no fish farms were registered. Hence, this gives an indication of fish tags possibly arriving by means of ocean circulation and hydrodynamics. Meanwhile, oyster bags and mussle sheeting were not found.

Since the data was acquired through **citizen beach clean-ups and monitoring events**, some issues may come up. There is no standardized monitoring protocol with the result that information is collected in different ways. For example, the proposed length of monitored transects may vary along the different countries. Hence, the results of the beach clean-ups are recalculated to items per 100 m. In order to further improve the interpretation of the data, the amount of aquaculture related litter in relation to the total number of recovered items was calculated as well, and listed in Annex 4. Another problem with data from citizen beach clean-ups and monitoring events is the reliability. In particular, errors are more likely to occur, which can lead to more frequent outliers that are difficult to explain (e.g. Otok Levrnaka and Sakarun, Croatia).

Another possible issue to consider is the possibility that litter might have been **wrongly identified**, and aquaculture items end up in the wrong category. This can be deduced from the limited entries of aquaculture related waste during these surveys (percentages shown in Annex 4). In addition, these mistakes are more likely to occur within citizen sciences projects than during professional monitoring events. Lastly, Figure 10 only shows results from surveys at the northern coastline of the Mediterranean Sea. In order to make further conclusions on the state-of-the-art in the Mediterranean Sea, the southern coastline should be monitored as well.

3.3.1.3. Conclusion

The OSPAR, HELCOM and Marine LitterWatch databases all define four categories of litter items, directly related to aquaculture activities. Nevertheless, the litter inventory (Annex 1) demonstrates a much higher occurrence of specific items (n=19) (B). As a consequence, all other collected mariculture related litter items are categorised in other more general groups and are consequently not taken into account for this analysis. **Further subdivision would therefore be a good solution** in order to identify as many aquaculture related debris and sources of aquaculture related debris as possible. In addition, categories on debris originating from **finfish aquaculture activities are poorly represented** in all three databases. However, the litter inventory indicates the high complexity and the high number of elements related to fish farms. As stated in the different sections under 3.3.1.2. Results, **a lot of information is absent** for the Baltic Sea, the Mediterranean Sea, and to a lesser extent the North Sea. As a result, it is difficult to draw a balanced conclusion. Both the aquaculture facilities and litter reported in the different datasets are incomplete, and in some cases updates are even required. Nonetheless, it is clear that finfish aquaculture and shellfish aquaculture have the highest activity regarding mariculture in European waters.

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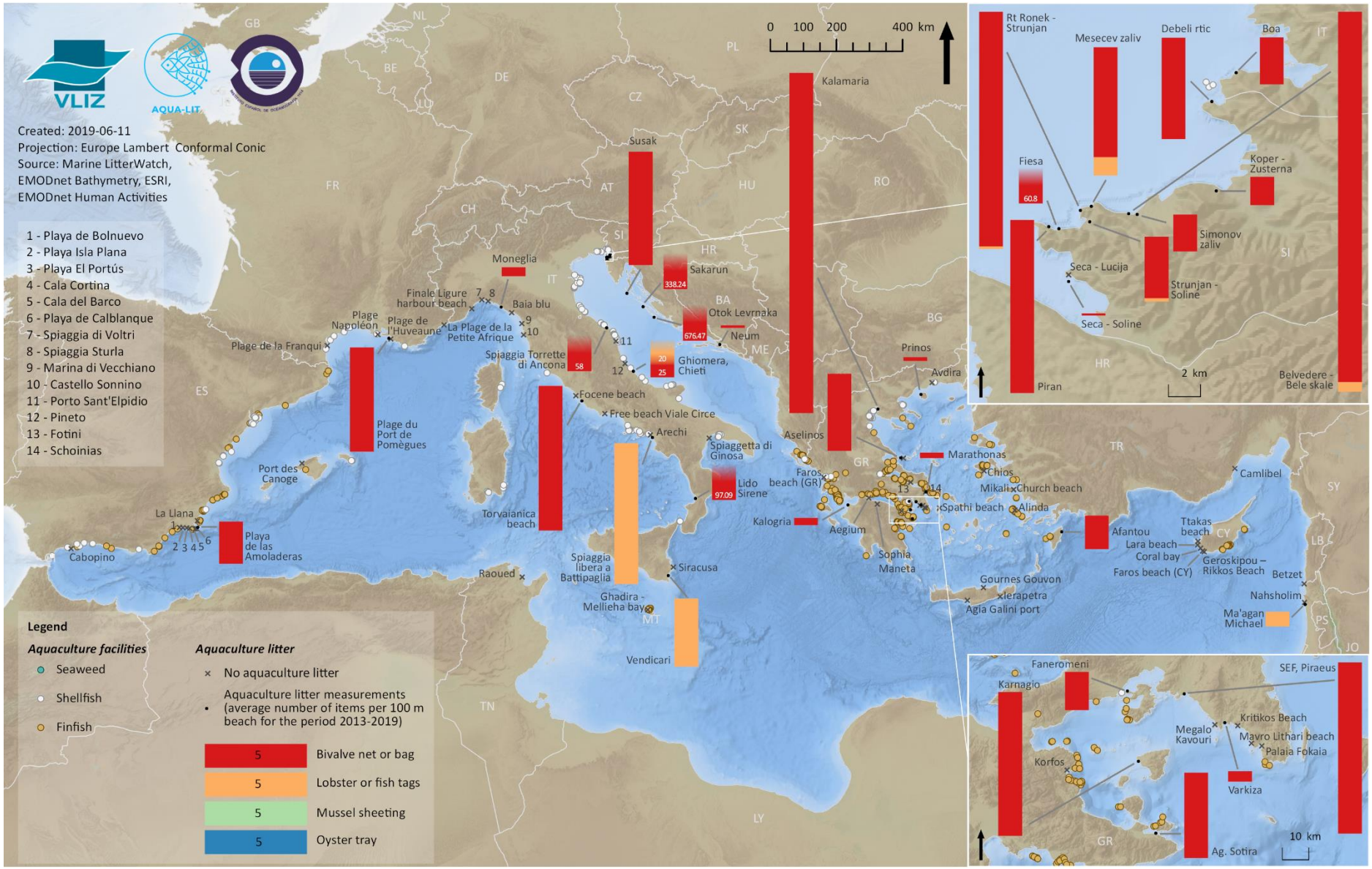

Figure 10: Distribution of aquaculture facilities and aquaculture related beach litter in the Mediterranean Sea basin (Source: Marine LitterWatch Database and EMODnet Human Activities).

3.3.2. Published quantities of aquaculture related debris

3.3.2.1. Methodology

In addition to the litter inventory, all collected literature (2009 - January 2019) was screened for potential reference to quantities of mariculture related litter recovered on beaches, on the seabed or at the sea surface. This information was gathered in combination with the location, litter source, observation period, type of quantification and the item itself. When possible, coordinates of the locations were listed and used to create an overall map of the North Sea, Baltic Sea and Mediterranean Sea. The unit of the reported quantities are very divergent and can range from items/100m or m² to kg or tonnes/annum. **To obtain some consistency in these data, the proportion of aquaculture related litter in relation to the total amount of recovered litter was extracted or calculated from the published data**. Hence, the results of most published articles can be compared and visualised geographically (Figures 11, 12 and 13). For this purpose, several authors were contacted and requested to share their monitoring locations with the AQUA-LIT consortium. We would like to note the crucial cooperation with Dr. Thomais Vlachogianni of the DeFishGear project and MIO-ECSDE, and Dr. Pierluigi Strafella from ISMAR CNR Italy. Througout this project, this database will be updated on a regular basis for as long as information is sent.

Besides plotting the data on a map, all references to quantities (with any unit) are listed in a table (Annex 5), to aid the presentation of the visualised data. The parameters used in this summary are explained in Table 2. One of the parameters is the 'Litter inventory number'. This reference number is the same code that was given to each item in the litter inventory (Annex 1). Hence, both datasets are directly linked to each other and can be used together for analysis.

Table 2: The parameters used in the table: 'Published quantities of aquaculture related debris' (Annex 5).

Parameter	Decription
Sea basin	Default choice: North Sea – Mediterranean Sea – Baltic Sea
Sea or waters	e.g. Adriatic Sea, Ligurian Sea, Gulf of Gabes, etc.
Country	
Year(s) of observation	
Item	The name of the aquaculture related litter item that is mentioned in the publication. If not available, other information is included in the column 'Group of items', 'Litter source' and 'Material'.
Litter inventory number	The reference number/code of the item indicated in the litter inventory (Annex 1).
Material	The material type of the item mentioned above (e.g. plastic, metal, concrete, etc.).
Quantity	The quantity of this item that was found in a certain area.
Standard deviation	The standard deviation of the quantity.
Unit	The unit used for quantity (e.g. items/km², items/l, items/100m, tonnes/year, etc.).
Litter source	Default choice: Aquaculture – Aquaculture/Fisheries – Aquaculture/General
Group of items	In case the specific item is not mentioned in the column 'Item', the term 'All waste' in the column 'Group of items' indicates that the mentioned quantity or percentage refers to all waste of the cited litter source (e.g. Aquaculture/Fisheries) with possible further distinction by material type (e.g. plastic).
Fate	Default choice: Beach – Sea surface – Seabed
% of total litter	The proportion of aquaculture related litter in relation to the total amount of recovered litter extracted or calculated from the published data.
Reference	Citation of the publication with link to IMIS.

3.3.2.2. Results

The collected data points are **mainly located in the Mediterranean Sea**, in particular the Adriatic and Ionian Sea. Although the data points are primarily derived from seabed surveys, most publications were based on beach litter monitoring events. Two-thirds of the observations took place after 2013 and 80% of the recorded aquaculture items were exclusively related to aquaculture. Most of the other items were related to aquaculture and fisheries. Buoys, ropes and collecting materials (e.g. fish boxes, crates, etc.), were most frequently found in the category of general items, and mainly nets (especially mussel/oyster nets and mesh bags) were reported within the specific items category. More than 90% of all reported items are partially or completely made of plastic. Since, almost all data is derived from monitoring events in the Mediterranean Sea, no significant differences could be identified between the three sea basins with regard to the reported item types and materials.

In order to get a clear view on the wide range of data, three different maps where created according to the fate (beach, floating and seafloor litter) of the collected litter (Figures 11, 12 and 13).

❖ Beach litter

The locations of the beach litter surveys from several published studies along with the data from OSPAR, HELCOM and Marine LitterWatch are illustrated in Figure 11. Every data point is marked with a colour which represents the proportion of aquaculture related litter in relation to the total amount of recovered litter. For example, light yellow is equal to a value between 0-5%, and red represents a percentage of more than 15%. These values were determined on the basis of the median. In some studies, only absolute (e.g. items/100m), and no relative (%), quantities were reported. The locations of these data are indicated on the map in dark grey. Furthermore, the data is divided into litter directly related to aquaculture (indicated on Figure 11 with a square), and litter which can be connected to multiple offshore sectors (marked on the map with a circle).

In general, the average percentage of aquaculture related litter in relation to the total amount of collected litter on beaches is **4.08%**. Nevertheless, when the OSPAR, HELCOM and Marine LitterWatch data are excluded, and only the data from the publications remains, the average percentage of aquaculture related litter in relation to the total amount of recovered litter on beaches is **12.33%**. A remarkable result is the fact that beaches in the North-western Adriatic Sea and in the region of the island of Corfu have considerably higher proportions of aquaculture related debris than the South-eastern Adriatic coasts. The highest percentage can be found on the island of Elba and near Barcelona. Interestingly, very few studies make a difference between aquaculture related and fisheries related litter. As a consequence, most of the published data in the Mediterranean Sea cannot be uniquely linked to aquaculture activities and are therefore marked by a circle. Lastly, it's noticeable that no data is available on the state-of-art of South-Mediterranean beaches.

❖ Floating litter

In Figure 12, the positions of the observational transects for floating litter are plotted in combination with a representation of the amount of aquaculture related debris reported. This was again done with the same colour scheme as used in Figure 11. All information was collected during visual surveys, and all convenient data were related to both aquaculture and fisheries activities. In other words, none of the litter items were uniquely linked to aquaculture. The

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surveys were exclusively performed in the Mediterranean Sea and an average of **11.25%** of the detected litter was related to aquaculture and fisheries. In the Ligurian Sea and the Gulf of Lion a wider area is highlighted in Figure 12. This polygon represents a series of transects which were monitored during multiple visual surveys by the same research group (Di-Meglio et al., 2017). In this area the proportion of aquaculture related litter in relation to the total amount of recovered litter is approximately 9.5%.

- Seafloor litter

Besides the beach and floating litter monitoring, both bottom trawl surveys and visual surveys with scuba/snorkelling were conducted to map seafloor litter. The results of these studies are visualised in a similar way, as in Figures 11 and 12, in Figure 13. The seafloor litter data are exclusively available for the Mediterranean Sea basin. As within the beach litter results (see section 'Beach litter' above), the North-western Adriatic Sea and the region of Corfu island show the highest percentages of aquaculture related debris. The average percentage of aquaculture related debris on the seafloor is **14.75%**. In comparison with the beach (4.08%) and sea surface (11.25%) data (see sections 'Beach litter' and 'Floating litter' above), one can conclude that the **highest proportion** of mariculture related litter in relation to the total amount of litter is found on the seafloor. Anyway, these surveys only took place on the seabed of shallow waters. Hence no statements can be made on the amount of litter in deeper waters.

3.3.2.3. Conclusion

It is remarkable that the proportion of aquaculture related litter in relation to the total amount of litter found on beaches (4.08%) is much lower than at the sea surface and on the seafloor. An even more notable result is the difference between the proportion of aquaculture litter with (4.08%) and without (12.33%) the OSPAR, HELCOM and Marine LitterWatch data (see section 'Beach litter' above). This contrast is probably due to the fact that the OSPAR, HELCOM and Marine LitterWatch data can be uniquely linked to aquaculture and only take four litter items into account, while the data from the publications is mainly related to aquaculture and fisheries. Therefore, the latter not only includes specific items (B), but also general litter items (A). As a consequence, **the proportion of aquaculture related litter in relation to the total amount of litter might be an overestimation for the published data and an underestimation for the OSPAR, HELCOM and Marine LitterWatch data**. The same can be assumed for the floating litter and seafloor litter. Since the percentages of aquaculture related floating litter (11.25%) and seafloor litter (14.75%) are based on both specific and general items, it may be concluded that the actual proportion of aquaculture related litter in relation to the total amount of litter is lower than the published results. Nevertheless, the general items can not be fully excluded since they might partly originate from aquaculture activities.

In general, these three maps (Figures 11, 12 and 13) indicate **information gaps in several parts of the Mediterranean Sea, North Sea and Baltic Sea**. More specific, little to no data is available on the amount of aquaculture related debris in the Alboran, Balearic, Libyan, Levantine, Aegean and Tyrrhenian Sea, Gulf of Gabes, Gulf of Lion, Sea of Sicily and almost the entire southern coastline of the Mediterranean Sea on both beaches, the sea surface and the seafloor. Furthermore, in the Greater North Sea and the Baltic Sea there is no information on the amount of aquaculture related debris at the sea surface and on the seabed. Currently, only the OSPAR and HELCOM databases give an indication of the quantities of aquaculture related beach litter present in these regions.

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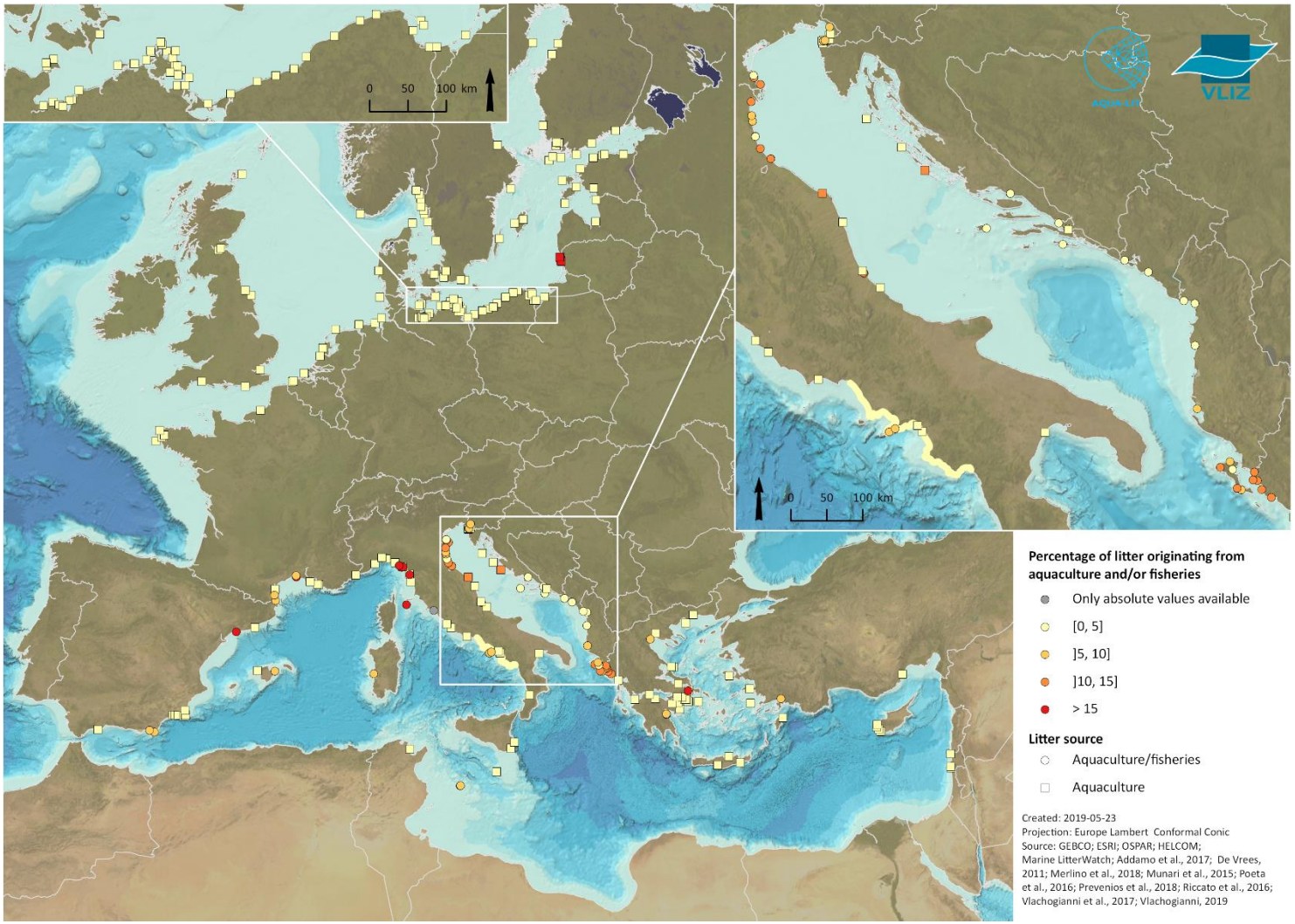

Figure 11: The monitored beaches in the North, Baltic and Mediterranean Sea basins and their reported percentage of aquaculture related litter. On the map above, the locations of the beach litter monitoring events are plotted in combination with a representation of the amount of aquaculture related litter reported. This is done by a colour scheme which represents the proportion of aquaculture related litter in relation to the total amount of recovered litter. These values were determined on the basis of the median. In some studies, only absolute, and no relative quantities were reported. The latter are indicated on this map in dark grey. The results which can only be linked to aquaculture are illustrated with a square, while more general results (aquaculture/fisheries related items) are represented by a circle.

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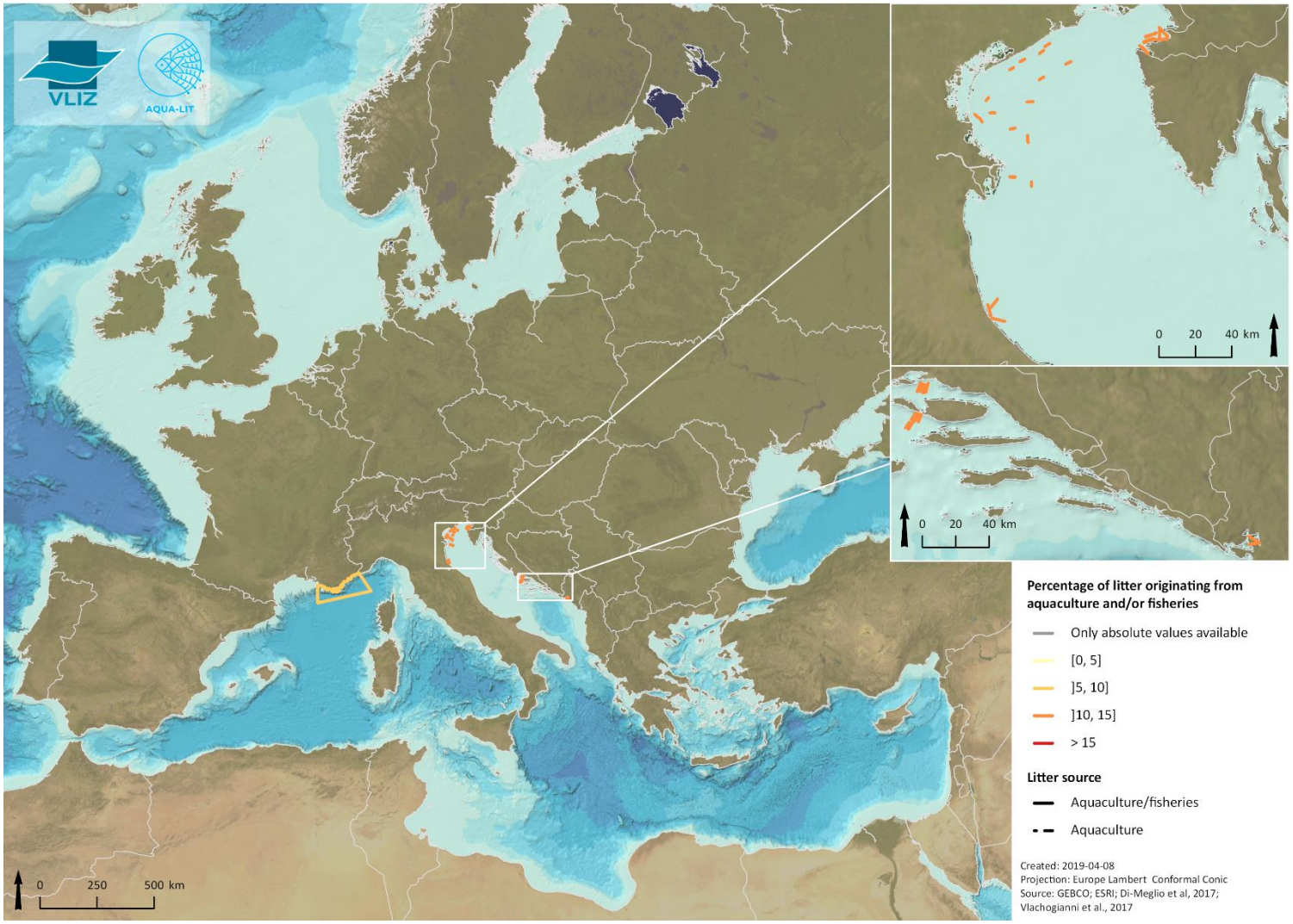

Figure 12: The observational transects in the North, Baltic and Mediterranean Sea basins and their reported percentage of aquaculture related litter. On the map above, the positions of the observational transects for floating litter are plotted in combination with a representation of the amount of aquaculture related litter reported. This is done by a colour scheme which represents the proportion of aquaculture related litter in relation to the total amount of recovered litter. These values were determined on the basis of the median. The polygon located partially in the Ligurian Sea and the Gulf of Lion represents a series of transects which were monitored during multiple visual surveys by the same research group.

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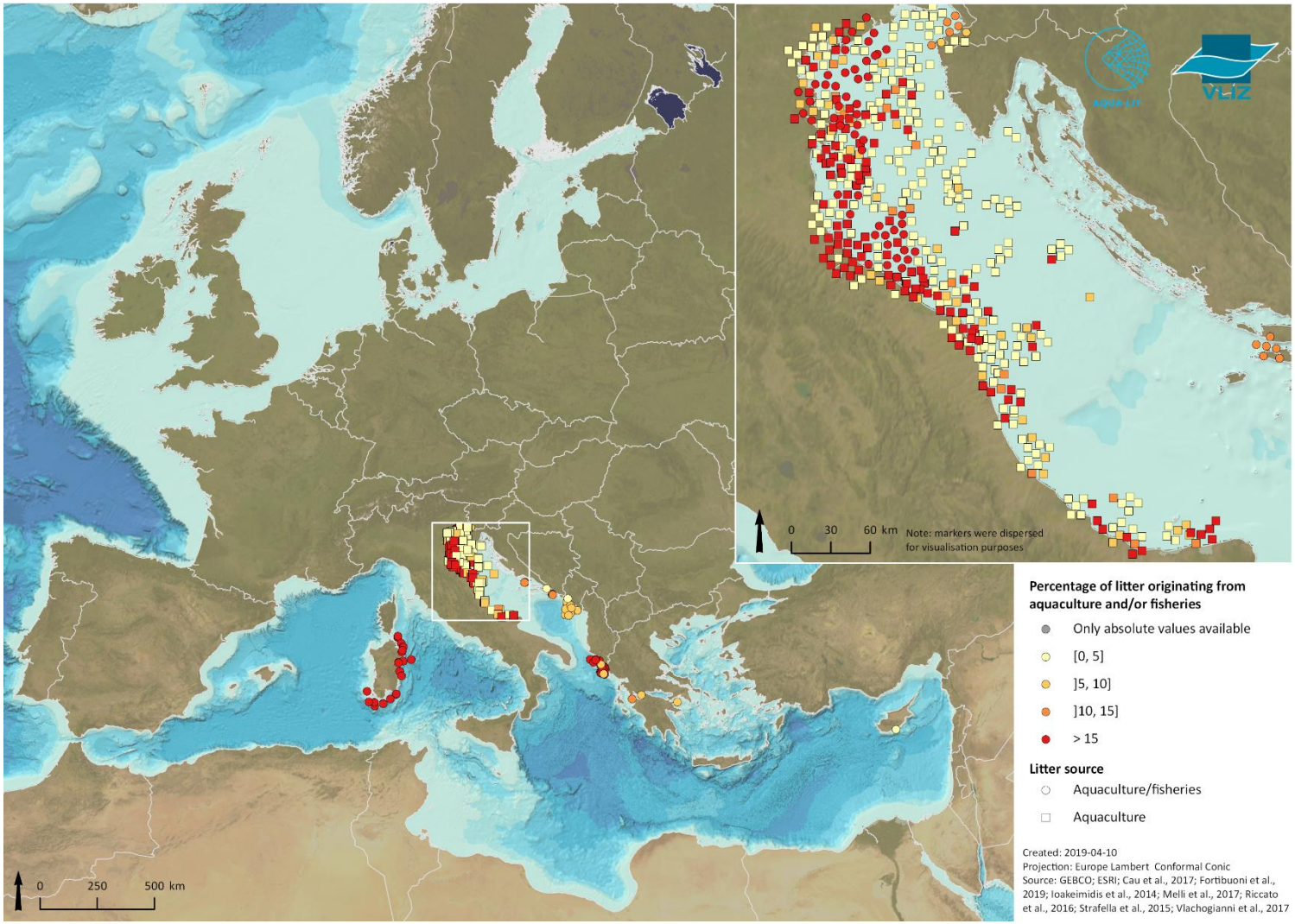

Figure 13: **The locations of the seafloor surveys in the North, Baltic and Mediterranean Sea basins and their reported percentage of aquaculture related litter.** On the map above, the positions of the bottom trawls and diving campaigns are plotted in combination with a representation of the amount of aquaculture related litter reported. This is done by a colour scheme which represents the proportion of aquaculture related litter in relation to the total amount of recovered litter. These values were determined on the basis of the median. The results which can only be linked to aquaculture are illustrated with a square, while more general results (aquaculture/fisheries related items) are represented by a circle.

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4. Highlights and Knowledge gaps

- There are many aquaculture activities carried out in Europe, unfortunately it is currently not possible to display all aquaculture facilities due to the **lack of data** from many countries.
- **Important farmed species** in the North Sea region are salmon, rainbow trout, mussel species, oysters and brown seaweeds. In the Baltic Sea region, mainly rainbow trout, mussels and oysters and brown seaweeds are farmed, and for the Mediterranean Sea region mussels, oysters and other clams, European seabass and a wider variety of finfish, red and green algae belong to the farmed species.
- Depending on the type of aquaculture facility, different types of waste can be expected. The '**AQUA-LIT litter inventory**' contains aquaculture items that are currently already found as marine debris and this list will be completed during the course of the AQUA-LIT project.
- Most of the litter items from the litter inventory consist of **plastic**, which certainly shows that measures need to be taken to tackle plastic litter from the aquaculture sector.
- At regional level, **monitoring programmes should be harmonised** between the regions and between the countries (e.g. HELCOM, OSPAR). Currently, different codes are used for the objects, and the units used in the reporting are also different. As a consequence, it's difficult to compare the results between countries and sea basins. Furthermore, there is no official monitoring programme for the Mediterranean Sea region, currently the data are based on citizen science initiatives.
- This report contains **maps for the North, Baltic and Mediterranean Sea regions** that for the first time ever document the presence of aquaculture debris in these areas, based on available data. The maps drawn up in this report also give an indication of the data gaps in different parts of the three sea areas.
- The monitoring programme that exists for seafloor litter (e.g. OSPAR) does not provide a category for aquaculture debris.
- There is a **need for open-access hydrodynamic models** that demonstrate the distribution of different types of litter in the North and Baltic Sea. Currently there are models that show the drift patterns of oil spills in the North and Irish Sea but the applicability of these models for marine litter is not known. These models should also distinguish different materials and forms of litter. For the Mediterranean Sea, a hydrodynamic model was developed by the INDICIT project.

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5. Future steps

5.1. Stakeholder surveys

The AQUA-LIT consortium aims to ensure **continuous engagement with stakeholders** through interviews, workshops and other forms of engagement (i.e. advisory board) throughout the project with following specific objectives in mind:

- Obtain relevant input to the project;
- Obtain the review of project results and recommendations as to ensure their relevance, timeliness, and comprehensiveness, and ensure stakeholders' commitment towards their implementation;
- Inform stakeholders and raise their awareness;
- Provide input to and ensued alignment with other relevant projects which might be interested in AQUA-LIT results.

After the initial desk research summarising the state-of-the-art knowledge on the type of aquaculture facilities and the marine litter originating from the aquaculture sector, **stakeholder surveys** will be held with relevant stakeholders from various sectors and stages in a life cycle of an aquaculture farm. The aim of these surveys is to obtain first hand (missing or incomplete) information for the project and ensure revision of the information from Deliverable 2.2 (D2.2).

At least 15 stakeholders from various sectors and stages in a life cycle of an aquaculture farm will be contacted in each sea basin to fill the information gaps identified at the end of the desk research (Chapter 4). The stakeholder surveys will preferably be held by interviews in person or by phone.

The combined information from the desktop study with the input from the stakeholder consultations and the discussions during the learning labs will be essential for the development of policy recommendations.

5.2. Upcoming actions

This report (D2.2) will be combined with report D2.3 on 'Available tools and measures'. These reports contribute to the knowledge base needed for:

- The **AQUA-LIT workshops** (learning labs). These multi-actor labs will provide a forum for the face to face work with the aquaculture farmers, policy makers and other relevant actors or stakeholders;
- The '**AQUA-LIT toolbox for integrated approaches**' will provide best practices for the aquaculture sector along the aquaculture chain to minimize impacts on the marine environment;
- '**Scaling up the tide**': how to overcome barriers for an integrated governance and economic development to reduce littering from the sector of aquaculture.

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7. Annexes

Annex 1: Litter inventory.

The litter inventory is a solid knowledge base on marine litter from aquaculture activities which is divided into general (A), specific (B) and other potential (C) items. Each item is characterized by an identification number, item type, description, material type, cultivated species, aquaculture type, picture, and literature source.

No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A01	Ropes	Synthetic ropes	Synthetic ropes (marily made of polysteel which is a blend of PP and PE, which has a 25 percent higher tensile strength than PP. Although, polyester and PA can be used, they are more expensive and more elastic than polysteel)	Plastic	n.a.	n.a.	Lusher et al., 2017 and Stachowitsch, 2019	
A02	Ropes	Other ropes	Other ropes (natural products)	Natural textile	n.a.	n.a.	OSPAR beach litter guidelines nr 31	
A03	Ropes	String and cord	String, cord and pieces of net	Plastic, natural textile	n.a.	n.a.	OSPAR beach litter guidelines nr 32, 115 & 116	
A04	Nets	General nets	Tangled nets/cord/rope and string + net repair pieces	Plastic	n.a.	n.a.	OSPAR beach litter guidelines nr 33	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A05	Nets	Plastic netting for cages	Made of UV-stabilized polyethylene	Plastic	n.a.	n.a.	Niaounakis, 2017	
A06	Pallets	Wooden Pallets	Wooden pallets	Wood	n.a.	n.a.	OSPAR beach litter guidelines nr 69	
A07	Floats and buoys	Markers buoys	Made of moulded PE and filled with PU or PS for additional buoyancy	Plastic	n.a.	n.a.	OSPAR beach litter guidelines nr 37	
A08	Floats and buoys	Plastic drums (+ caps)	For flotation	Plastic	n.a.	n.a.	Lusher et al., 2017	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A09	Collecting material	Plastic buckets	Plastic buckets for seafood collection	Plastic	n.a.	n.a.	OSPAR beach litter guideline nr 38	
A10	Collecting material	Lug baskets and containers	Plastic lug baskets and containers for seafood collection	Plastic	n.a.	n.a.	Niaounakis, 2017	
A11	Collecting material	Plastic fish boxes	Fish boxes for seafood collection	Plastic	n.a.	n.a.	OSPAR beach litter guidelines nr 34	
A12	Collecting material	Wooden fish boxes	Fish boxes for seafood collection	Wood	n.a.	n.a.	OSPAR beach litter guidelines nr 119	

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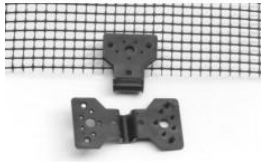
No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A13	Collecting material	EPS fish boxes	Fish boxes for seafood collection	Plastic	n.a.	n.a.	Di-Meglio et al., 2017	
A14	Collecting material	Burlap bags	For seafood collection	Natural textile	n.a.	n.a.	OSPAR beach litter guidelines nr 56	
A15	Strapping material	Strapping bands	Strapping material	Plastic	n.a.	n.a.	OSPAR beach litter guideline nr 39	
A16	Strapping material	Polyclips	Strapping material	Plastic	n.a.	n.a.	OSPAR beach litter guideline nr 39	

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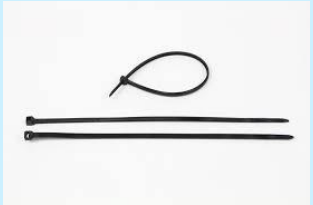
No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A17	Strapping material	Cable ties	Strapping material	Plastic	n.a.	n.a.	OSPAR beach litter guideline nr 39	
A18	Clothing	Gloves	Industrial/professional gloves (e.g gut gloves)	Plastic, rubber	n.a.	n.a.	OSPAR beach litter guidelines nr 113	
A19	Clothing	Hard hats	Safety hats	Plastic	n.a.	n.a.	OSPAR beach litter guideline nr 42	
A20	Clothing	Boots	Safety boots / rubber boots	Rubber	n.a.	n.a.	OSPAR beach litter guideline nr 50	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A21	Clothing	Other clothing	Safety jackets, reflective jackets, pants, sweater…	Plastic	n.a.	n.a.	OSPAR beach litter guideline nr 54	
A22	Structure	PVC and HDPE pipes and containers	For flotation and stability	Plastic	n.a.	n.a.	Lusher et al., 2017	
A23	Structure	Thimble	Thimble for rope attachment	Metal	n.a.	n.a.	Cardia and Lovatelli, 2015	
A24	Structure	Stakes	Stakes are used as growth medium	Wood	n.a.	n.a.	Macfadyen et al., 2009	

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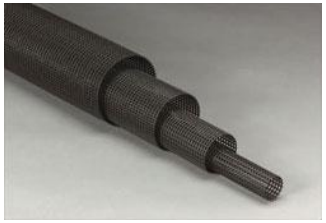
No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A25	Other	Industrial scrap	Metal materials	Metal	n.a.	n.a.	OSPAR beach litter guideline nr 83	
A26	Other	Plastic mesh filter tubes	Plastic mesh filter tubes	Plastic	n.a.	n.a.	Niaounakis, 2017	
A27	Other	Jerry cans	As marker buoys or liquid container	Plastic	n.a.	n.a.	OSPAR beach litter guidelines nr 10	
A28	Floats and buoys	Plastic bottles	Plastic bottles are used as a buoy, to signal the presence of the poles	Plastic	n.a.	n.a.	Merlino et al., 2018	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
GENERAL ITEMS								
A29	Floats and buoys	Caps of plastic bottles	Part of bottles who are used as marker buoys	Plastic	n.a.	n.a.	Merlino et al., 2018	
A30	Floats and buoys	Metal drums	For flotation	Metal	n.a.	n.a.	Ioakeimidis et al., 2014	
A31	Floats and buoys	Bobbins	For flotation	Plastic, Rubber	n.a.	n.a.	Ioakeimidis et al., 2014	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
SPECIFIC ITEMS								
B01	Tags	Lobster and fish tags	Identification of the cultured organisms	Plastic	Fish & Crustaceans (lobster)	Net cages	OSPAR beach litter guidelines nr 114	
B02	Nets	Oyster nets or mussel bags	Mussel and oysters can be cultivated using a net or bags	Plastic	Bivalves (mussel, oyster)	Rack and bag system / bottom and suspended rope culture	OSPAR beach litter guidelines nr 28	
B03	Nets	Anti-predator netting	Antibird/Antipredator netting (made of UV-stabilized polypropylene or polyethylene, polypropylene and nylon monofilament twine	Plastic	Fish	Net cages	Kershaw and Rochman, 2016	
B04	Nets	Plastic mesh bags	PE mesh bags (for scallop spat collection)	Plastic	Bivalves (oysters, clams, scallops, mussels and cockles) and crustaceans	Suspended rope culture	Lusher et al., 2017	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
SPECIFIC ITEMS								
B05	Nets	Plastic mesh screens	Plastic mesh screens protect organisms from predators (crabs and birds) and heatwaves (made from PE and PP)	Plastic	Bivalves (oysters, clams, scallops, mussels and cockles) and crustaceans	Net cages / pole, bottom and suspended rope culture	Lusher et al., 2017	
B06	Nets	Mussel socks/nets	Cotton or nylon mussel socks/nets for cultivation and packaging.	Plastic (nylon) or natural textile (cotton)	Bivalves (mussel)	Suspended rope culture	CleanSea project; Moschino et al., 2019	
B07	Nets	Lantern nets	Lantern nets are used for spat collection	Plastic	Bivalves	Suspended rope culture	Lusher et al., 2017	
B08	Floats and buoys	EPS buoys	Aquaculture fisheries mainly use 60L (1.2)-kg EPS bouys that last 2-3 years. The discarded buoys become weighted down by fouling microorganisms and brine, whereas some of them fragment. EPS buoys are easily removed from nets by winds and currents, and large quantities are lost and concentrated on beaches and coasts.	Plastic	Bivalves	Suspended rope culture	OSPAR beach litter guidelines nr 37	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
SPECIFIC ITEMS								
B09	Floats and buoys	Deep water buoy	Deep water buoy to mark location of the ropes	Plastic	Fish	Net cages	Cardia and Lovatelli, 2015	
B10	Structure	Oyster trays	Plastic structure from oyster cultures	Plastic	Bivalves (oyster)	Suspended rope culture	OSPAR beach litter guidelines nr 29	
B11	Structure	Tahitians	Plastic sheeting from mussel culture (mussel sheeting)	Plastic	Bivalves (mussel)	Pole culture	OSPAR beach litter guidelines nr 30	
B12	Structure	Heavy-duty longlines	Sub surface longlines who smaller growth ropes together	Plastic	Bivalves (oyster), brown seaweed	Suspended rope culture	Niaounakis, 2017	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
SPECIFIC ITEMS								
B13	Structure	Plastic trays	Polyethylene trays	Plastic	Bivalves (oysters and scallops)	Suspended rope culture	Lusher et al., 2017	
B14	Structure	Oyster sticks	Wooden sticks for growth	Wood	Bivalves (oyster)	Pole culture	Sherrington et al., 2016	
B15	Structure	HDPE Plastic brackets	To hold plastic pipes together for flotation	Plastic	Fish	Net cages	Lusher et al., 2017	
B16	Structure	PS floats	For flotation	Plastic	Fish	Net cages	Lusher et al., 2017	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
SPECIFIC ITEMS								
B17	Structure	Mooring bracket	To hold plastic pipes together for flotation	Plastic	Fish	Net cages	Lusher et al., 2017	
B18	Other	Plastic stoppers	Plastic stoppers used in oyster and mussels nets	Plastic	Bivalves (mussel, oyster)	Rack and bag system / bottom and suspended rope culture	OSPAR beach litter guidelines nr 28	
B19	Floats and buoys	Pontoons	Aquaculture pontoons and fishing net floats	Plastic	n.a.	Net cages	OceanWise project	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
OTHER POTENTIAL ITEMS								
C01	Structure	Mussel cone laser marking	To mark mussel cultures	Metal	Bivalves (mussels)	Pole culture	Francis Kerckhof (RBINS)	
C02	Structure	Concrete sinkers	To hold the net cage in correct shape	Concrete	Fish	Net cages	Cardia and Lovatelli, 2015	
C03	Structure	Mesh bags	Mesh bags filled with sand, gravel or small pebbles for use as sinker ballasts	Plastic	Fish	Net cages	Cardia and Lovatelli, 2015	
C04	Structure	Stud link chains	Stud link chains used as sinkers. Chains are preferable for use as net tensioning ballasts because of the greater weight in water of steel, compared with concrete, stones or other materials.	Steel	Fish	Net cages	Cardia and Lovatelli, 2015	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
OTHER POTENTIAL ITEMS								
C05	Structure	Polystyrene cylinders	Inserted into the pipes for extra flotation	Plastic	Fish	Net cages	Cardia and Lovatelli, 2015	
C06	Structure	HDPE connection element	HDPE connection element for sinker tube	Plastic	Fish	Net cages	Cardia and Lovatelli, 2015	
C07	Structure	Corner plate	Used to connect the main mooring lines and bridles	Steel	Fish	Net cages	Cardia and Lovatelli, 2015	
C08	Structure	Steel rings	Used as connecting element in the grid system	Steel	Fish	Net cages	Cardia and Lovatelli, 2015	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
OTHER POTENTIAL ITEMS								
C09	Structure	Racks	Used to secure mussel and oyster bags	Metal	Bivalves (mussel, oyster)	Rack and bag system / bottom culture	Go Deep International Inc.	
C10	Other	Diving equipment	Used by divers during maintainance	Diverse	n.a.	n.a.	Expert contact	
C11	Other	Life jackets- life savers	Used by operation and maintainance personal	Diverse	n.a.	n.a.	Expert contact	
C12	Other	Boat	Used by operation and maintainance personal	Plastic, wood	n.a.	n.a.	Expert contact	

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No.	Item type	Item	Description	Material	Aquaculture species	Aquaculture type	Source	Picture
OTHER POTENTIAL ITEMS								
C13	Other	Padlocks	Used by operation and maintainance personal	Metal	n.a.	n.a.	Expert contact	
C14	Structure	Taquets	Taquets, or clamps, are plastic tubes used in French mussel farming to prevent mussels from collapsing or coming off at harvest time.	Plastic	Bivalves (mussels)	Suspended rope culture	Frances Kerckhof (RBINS)	

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Annex 2: Average number of observed aquaculture-related litter items on multiple North Sea beaches monitored by OSPAR between 2009-2019.

Numbers are reported as number of items per 100 m beach with standard deviation (Source: OSPAR Beach Litter Database via Francis Kerckhof, RBINS).

Country	Beach/City	Period	Lobster and fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
NORTHERN NORTH SEA								
Denmark	Nymindegab Strand	2011-2018	0.47 ± 0.84	0.26 ± 0.45	0.05 ± 0.23	0.11 ± 0.32	0.89 ± 1.03	0.29
	Skagen Skagen Strand	2015-2018	7.83 ± 20.24	0	0	0.17 ± 0.39	8.00 ± 20.24	0.45
Norway	Kviljo	2011-2018	0	0	0	0	0	0
	Ytre Hvaler	2012-2018	13.57 ± 9.18	5.86 ± 14.22	0	3.71 ± 5.22	24.17 ± 17.71	0.13
Sweden	Edshultshall	2011-2018	0.25 ± 0.61	0	0	0.42 ± 1.06	0.67 ± 1.22	0.25
	Edsvik	2009-2018	2.20 ± 6.06	0.84 ± 4.20	0.12 ± 0.44	1.52 ± 5.01	4.68 ± 8.93	0.02
	Gröderhamn	2011-2018	1.08 ± 2.18	0.04 ± 0.20	0.04 ± 0.20	0.52 ± 0.92	1.68 ± 2.38	0.1
	Grönevik	2011-2018	0	0.70 ± 0.70	0.00 ± 0.00	1.32 ± 1.32	1.59 ± 1.49	0.89
	Haby	2009-2018	0	0	0	0.04 ± 0.19	0.04 ± 0.19	0.005
	Saltö	2009-2018	1.54 ± 6.65	0.15 ± 0.46	0.04 ± 0.20	0.19 ± 0.57	1.92 ± 6.69	0.06
United Kingdom	Cramond Beach	2009-2019	0	0	0	0	0	0
United Kingdom	Mill Bay (Orkney)	2009-2017	0	0	0	0	0	0
	Kinghorn Harbour	2009-2018	0	0	0	0	0	0
	Robin Hood's Bay	2009-2019	0	0	0	0	0	0
	Saltburn	2009-2018	0	0	0	0	0	0
SOUTHERN NORTH SEA								
Belgium	Oostende	2012-2017	0	1.65 ± 2.31	0.13 ± 0.46	0.30 ± 0.47	2.09 ± 2.40	1.46
	Raversijde	2012-2017	0	1.56 ± 1.29	0	0.17 ± 0.38	1.72 ± 1.34	1.09
Germany	Juist	2009-2018	0.26 ± 0.75	0.15 ± 0.37	0	0.15 ± 0.59	0.56 ± 1.02	0.6
	Minsener Oog (island)	2009-2018	0	0.63 ± 3.33	0	0.13 ± 0.46	0.75 ± 3.36	0.58
	Scharhörn (island)	2009-2018	0.10 ± 0.31	0.52 ± 1.94	0	0.17 ± 0.76	0.79 ± 2.11	0.26
	Sylt (island)	2009-2018	0	0	0	0	0	0
France	Dieppe	2012-2018	0	0.81 ± 2.44	0	0	0.81 ± 2.44	0.72
	Koubou	2010-2018	0.44 ± 1.03	0.14 ± 0.54	0.17 ± 0.61	0.53 ± 1.40	1.28 ± 1.92	0.14

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Country	Beach/City	Period	Lobster and fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
NORTHERN NORTH SEA								
	Kerizella	2010-2018	0.19 ± 0.47	0.03 ± 0.17	0.06 ± 0.23	0.06 ± 0.23	0.33 ± 0.60	0.09
	Larmor Plougastel	2011-2018	0.38 ± 0.78	5.66 ± 7.88	0.79 ± 2.32	0.31 ± 1.67	7.14 ± 8.42	1.56
	Sein	2010-2018	0.09 ± 0.37	0.03 ± 0.17	0.03 ± 0.17	0.03 ± 0.17	0.17 ± 0.47	0.11
The Netherlands	Bergen	2009-2018	0.53 ± 1.22	0.30 ± 0.69	0.03 ± 0.16	0.10 ± 0.30	0.95 ± 1.44	0.23
	Noordwijk	2009-2019	0.83 ± 2.49	0.33 ± 0.57	0	0.15 ± 0.43	1.30 ± 2.59	0.34
	Terschelling	2009-2018	0.70 ± 1.36	0.53 ± 1.30	0.23 ± 0.62	0.25 ± 0.59	1.70 ± 2.06	0.7
	Veere	2009-2018	1.10 ± 1.91	0.43 ± 1.11	0.05 ± 0.32	0.25 ± 0.63	1.83 ± 2.32	1
United Kingdom	Jubilee Beach	2010-2018	0.10 ± 0.63	0	0	0	0.10 ± 0.63	0.01
	Rottingdean	2009-2018	0	0	0	0	0	0
	Seatown	2009-2018	0	0	0	0	0	0

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Annex 3: Average number of observed aquaculture-related litter items on multiple Baltic Sea beaches monitored by HELCOM between 2011-2018.

Numbers are reported as number of items per 100 m beach with standard deviation. In order to interpret the Annex 3 correctly, it should be noted that for Estonia and Poland no data was available on the length of the monitored transect (presumably 100 m) and that surveys were probably carried out between 2011-2018 but no exact dates were registered. In addition, the data for Estonia, Finland, Germany and Sweden was collected using a different coding method. As a consequence, only the category 'mussel and oyster nets' [G45] for Estonia, Finland and Sweden, and the category 'plastic sheeting from mussel culture' [G47] for Germany were included in Annex 3 (Source: HELCOM Beach Litter Database).

Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
Denmark	Kofoeds enge, Amager	2015-2016	0	0	0	0	0	0
	Pomlenakke, Falster	2015-2016	0	0	0	0	0	0
	Risø, Roskilde	2015-2016	0.14 ± 0.35	0	0	0	0.14 ± 0.35	0.07
Estonia	Kaleste	n.a.	n.a.	0	n.a.	n.a.	0	0
	Kolga-Aabla	n.a.	n.a.	0	n.a.	n.a.	0	0
	Loksa	n.a.	n.a.	0	n.a.	n.a.	0	0
	Metsapoole	n.a.	n.a.	0	n.a.	n.a.	0	0
	Nova	n.a.	n.a.	0	n.a.	n.a.	0	0
	Ohessaare	n.a.	n.a.	0	n.a.	n.a.	0	0
	Orissaare	n.a.	n.a.	0	n.a.	n.a.	0	0
	Saka	n.a.	n.a.	0.15 ± 0.36	n.a.	n.a.	0.15 ± 0.36	5
	Valgeranna	n.a.	n.a.	0.23 ± 0.58	n.a.	n.a.	0.23 ± 0.58	0.14
	Viimsi	n.a.	n.a.	0.15 ± 0.36	n.a.	n.a.	0.15 ± 0.36	0.26
Finland	Björkö	2012-2018	n.a.	0.14 ± 0.35	n.a.	n.a.	0.14 ± 0.35	0.18
	Helsinki Pihlajasaari	2012-2018	n.a.	0	n.a.	n.a.	0	0
	Jussarö	2014-2015	n.a.	0.33 ± 0.47	n.a.	n.a.	0.33 ± 0.47	0.04
	Kaarina	2012-2018	n.a.	0.10 ± 0.29	n.a.	n.a.	0.10 ± 0.29	0.04
	Kalajoki	2015-2018	n.a.	0	n.a.	n.a.	0	0
	Kokkola	2015-2018	n.a.	0	n.a.	n.a.	0	0
	Kotka inner	2012-2018	n.a.	0.11 ± 0.31	n.a.	n.a.	0.11 ± 0.31	0.25
	Kotka outer	2012-2018	n.a.	0.11 ± 0.31	n.a.	n.a.	0.11 ± 0.31	0.05
	Mustfinn	2012-2018	n.a.	0.26 ± 0.91	n.a.	n.a.	0.26 ± 0.91	0.33
	Örö	2016-2018	n.a.	0	n.a.	n.a.	0	0

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Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
	Turku Ruissalo	2012-2018	n.a.	0.05 ± 0.21	n.a.	n.a.	0.05 ± 0.21	0.01
	Utö	2012-2018	n.a.	0	n.a.	n.a.	0	0
Germany	Binz	2011-2016	n.a.	n.a.	n.a.	0	0	0
	Boiensdorf	2013-2014	n.a.	n.a.	n.a.	0	0	0
	Bug	2013-2017	n.a.	n.a.	n.a.	0	0	0
	Darß - Müller	2013-2017	n.a.	n.a.	n.a.	0	0	0
	Fehmarn - Grüner	2011-2017	n.a.	n.a.	n.a.	0.16 ± 0.78	0.16 ± 0.78	0.11
	Fehmarn - Krummsteert	2011-2017	n.a.	n.a.	n.a.	0	0	0
	Fehmarn - Waldhide	2011-2017	n.a.	n.a.	n.a.	0	0	0
	Glowe	2012-2017	n.a.	n.a.	n.a.	0	0	0
	Göhren	2011-2016	n.a.	n.a.	n.a.	0	0	0
	Greifwalder Oie	2013-2014	n.a.	n.a.	n.a.	0	0	0
	Hiddensee - Gellen	2013-2016	n.a.	n.a.	n.a.	0	0	0
	Hiddensee - Enddorn	2013-2015	n.a.	n.a.	n.a.	0	0	0
	Kägsdorf	2012-2017	n.a.	n.a.	n.a.	0.29 ± 1.03	0.29 ± 1.03	0.45
	Klein Zicker	2012-2013	n.a.	n.a.	n.a.	0	0	0
	Lubmin	2014-2017	n.a.	n.a.	n.a.	0	0	0
	Mukran	2012-2017	n.a.	n.a.	n.a.	0	0	0
	Nobbin	2012-2017	n.a.	n.a.	n.a.	0	0	0
	Poel	2013-2017	n.a.	n.a.	n.a.	0	0	0
	Rosenhagen	2013-2017	n.a.	n.a.	n.a.	0	0	0
	Sellin	2012-2017	n.a.	n.a.	n.a.	0	0	0
	Steinbeck	2013-2017	n.a.	n.a.	n.a.	0	0	0
	Stubbenkamer	2013-2016	n.a.	n.a.	n.a.	0	0	0
	Tarnewitz	2013-2014	n.a.	n.a.	n.a.	0	0	0
	Usedom – Peenemünde	2014-2017	n.a.	n.a.	n.a.	0	0	0
	Varnkevitz	2012-2016	n.a.	n.a.	n.a.	0	0	0
	Vilm	2012-2016	n.a.	n.a.	n.a.	0	0	0

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Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
	Wieschendorf	2014-2017	n.a.	n.a.	n.a.	0	0	0
	Zingst	2013-2017	n.a.	n.a.	n.a.	0	0	0
Lithuania	Nemirseta	2012-2013	0	0.25 ± 0.43	81.63 ± 13.79	0	81.88 ± 13.80	47.27
	Karkle	2012-2013	0	0	122.25 ± 30.03	0	122.25 ± 30.03	47.06
	Melnrage/ Klaipeda	2012-2013	0.13 ± 0.33	0.5 ± 1	159.88 ± 32.31	0	160.51 ± 32.33	47.23
	Palanga	2012-2013	0	0.13 ± 0.33	61.88 ± 29	0	62.01 ± 29	45.19
Poland	Choczewo	n.a.	0.88 ± 1.05	0	0	0	0.88 ± 1.05	0.38
	Darłowo	n.a.	0.25 ± 0.43	0	0	0	0.25 ± 0.43	0.11
	Dziwnów	n.a.	0.63 ± 1.11	0	0	0	0.63 ± 1.11	0.20
	Gdańsk	n.a.	1.63 ± 1.93	0	0	0	1.63 ± 1.93	0.68
	Gdynia	n.a.	1.25 ± 1.54	0	0	0	1.25 ± 1.54	0.51
	Hel (I)	n.a.	0.75 ± 0.83	0	0	0	0.75 ± 0.83	0.79
	Hel (II)	n.a.	1.63 ± 4.30	0	0	0	1.63 ± 4.30	0.60
	Kołobrzeg	n.a.	0.75 ± 1.30	0	0	0	0.75 ± 1.30	0.47
	Krynica Morska	n.a.	1.5 ± 2	0	0	0	1.5 ± 2	2.20
	Mielno	n.a.	1.88 ± 2.42	0	0	0	1.88 ± 2.42	0.15
	Smołdzino	n.a.	0.63 ± 1.11	0	0	0	0.63 ± 1.11	0.57
	Stegna	n.a.	2.13 ± 3.22	0	0	0	2.13 ± 3.22	1.60
	Świnoujście	n.a.	0.38 ± 0.70	0	0	0	0.38 ± 0.70	0.06
	Trzebiatów	n.a.	0.38 ± 1.05	0	0	0	0.38 ± 1.05	0.07
	Ustka	n.a.	0.63 ± 1.65	0	0	0	0.63 ± 1.65	0.07
Sweden	Järavallen/ Sjöängarna	2015-2016	n.a.	0.20 ± 0.40	n.a.	n.a.	0.20 ± 0.40	0.04
	Kårehamn strand/ Skanviken	2015-2016	n.a.	0.17 ± 0.37	n.a.	n.a.	0.17 ± 0.37	4.17
	Mälarhusen	2012-2016	n.a.	0	n.a.	n.a.	0	0
	Nåttarö	2013-2016	n.a.	0.07 ± 0.25	n.a.	n.a.	0.07 ± 0.25	0.34
	Nybrostrand	2015-2016	n.a.	0.17 ± 0.37	n.a.	n.a.	0.17 ± 0.37	0.44
	Rullsand	2013-2016	n.a.	0	n.a.	n.a.	0	0
	Sjauster	2012-2016	n.a.	0	n.a.	n.a.	0	0

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Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
	Storsand	2014-2016	n.a.	0.14 ± 0.35	n.a.	n.a.	0.14 ± 0.35	0.79
	Sudde strand/ Björkängs havsbad	2012-2016	n.a.	0	n.a.	n.a.	0	0
	Tofta	2012-2016	n.a.	0.67 ± 2.49	n.a.	n.a.	0.67 ± 2.49	0.19

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Annex 4: Average number of observed aquaculture-related litter items on multiple Mediterranean Sea beaches monitored by Marine LitterWatch between 2013-2019.

Numbers are reported as average number of items found per 100 m per beach with standard deviation. Besides this, the proportion of aquaculture related litter in relation to the total amount of recovered litter was calculated (Source: Marine LitterWatch Database).

Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
Bosnia and Herzegovina	Neum	2016	0	0.13	0	0	0.13	0.08
Croatia	Susak	2015	0	5.63	0	0	5.63	0.18
	Otok Levrnaka	2015	0	676.47	0	0	676.47	14.90
	Sakarun	2015	0	338.24	0	0	338.24	4.51
Cyprus	Coral bay	2018	0	0	0	0	0	0
	Faros beach (CY)	2018	0	0	0	0	0	0
	Geroskipou – Rikkos Beach	2018	0	0	0	0	0	0
	Lara Beach	2018	0	0	0	0	0	0
	Ttakkas Beach	2018	0	0	0	0	0	0
France	Plage de la Franqui	2014	0	0	0	0	0	0
	Plage de l'Huveaune	2015	0	0	0	0	0	0
	Plage de la Petite Afrique	2018	0	0	0	0	0	0
	Plage du Port de Pomègues	2018	0	5.17	0	0	5.17	0.46
	Plage Napoléon	2018	0	0	0	0	0	0
Greece	Aegium	2016	0	0	0	0	0	0
	Afantou	2018	0	1.65	0	0	1.65	0.80
	Agia Galini port	2014	0	0	0	0	0	0
	Ag. Sotira	2015	0	4.24	0	0	4.24	0.16
	Alinda	2014	0	0	0	0	0	0
	Aselinos	2016	0	3.83	0	0	3.83	1.03
	Avdira	2014	0	0	0	0	0	0
	Chios	2018	0	0	0	0	0	0
	Church Beach	2015	0	0	0	0	0	0
	Faneromeni	2015	0	1.89	0	0	1.89	2.13

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Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
	Faros Beach (GR)	2016	0	0	0	0	0	0
	Fotini	2014	0	0	0	0	0	0
	Gournes Gouvon	2015	0	0	0	0	0	0
	Ierapetra	2015	0	0	0	0	0	0
	Kalamaria	2016	0	16.90	0	0	16.90	0.95
	Kalogria	2018	0	0.37	0	0	0.37	2.94
	Karnagio	2016	0	7.14	0	0	7.14	0.35
	Korfos	2015	0	0	0	0	0	0
	Kritikos beach	2016	0	0	0	0	0	0
	Marathonas	2017	0	0.28	0	0	0.28	0.09
	Mavro Lithari	2013-2016	0	0	0	0	0	0
	Megalo Kavouri	2016	0	0	0	0	0	0
	Mikali	2015	0	0	0	0	0	0
	Palaia Fokaia	2013	0	0	0	0	0	0
	Prinos	2016	0	0.19	0	0	0.19	0.11
	Schoinias	2018	0	0	0	0	0	0
	SEF, Piraeus	2013-2018	0	8.50 ± 14.73	0	0	8.50 ± 14.73	0.35
	Sophia Maneta	2013	0	0	0	0	0	0
	South beach of Arkos	2014	0	0	0	0	0	0
	Spathi beach	2013	0	0	0	0	0	0
	Varkiza	2014	0	0.52	0	0	0.52	0.09
Israel	Betzet	2015	0	0	0	0	0	0
	Maagan Michael	2015	0.72	0	0	0	0.72	1.08
	Nachsholim	2015	0	0	0	0	0	0
Italy	Arechi	2015	0	0	0	0	0	0
	Baia blu	2014-2018	0	0	0	0	0	0
	Boa	2019	0	2.34	0	0	2.34	4.87
	Castello Sonnino	2014	0	0	0	0	0	0

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Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
	Finale Ligure harbour beach	2018	0	0	0	0	0	0
	Focene beach	2016	0	0	0	0	0	0
	Free beach Viale Circe	2016	0	0	0	0	0	0
	Ghiomera, Chieti	2015	20	25	0	0	45	2.70
	Lido Sirene	2017	0	97.09	0	0	97.09	4.56
	Marina di Vecchiano	2015	0	0	0	0	0	0
	Moneglia	2014	0	0.44	0	0	0.44	0.25
	Pineto	2016	0	0	0	0	0	0
	Porto Sant'Elpidio	2016	0	0	0	0	0	0
	Siracusa	2018	0	0	0	0	0	0
	Spiaggetta di Ginosa	2015	0	0	0	0	0	0
	Spiaggia di Voltri	2016	0	0	0	0	0	0
	Spiaggia Libera a Battipaglia	2016	7	0	0	0	7	1.21
	Spiaggia Sturla	2016	0	0	0	0	0	0
	Spiaggia Torrette di Ancona	2017	0	58	0	0	58	11.65
	Torvaianica beach	2016	0	7.18	0	0	7.18	3.81
	Vendicari	2018	3.38 ± 5.85	0	0	0	3.38 ± 5.85	0.25
Malta	Ghadira - Mellieha Bay	2015	0	0	0	0	0	0
Spain	Cabopino	2014	0	0	0	0	0	0
	Cala Cortina	2018	0	0	0	0	0	0
	Cala del Barco	2018	0	0	0	0	0	0
	La Llana	2018	0	0	0	0	0	0
	Playa de Bolnuevo	2018	0	0	0	0	0	0
	Playa de Calblanque	2018	0	0	0	0	0	0
	Playa de las Amoladeras	2017-2018	0	2.08 ± 1.86	0	0	2.08 ± 1.86	2.99
	Playa El Portús	2018	0	0	0	0	0	0
	Playa Isla Plana	2018	0	0	0	0	0	0

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Country	Beach/City	Period	Fish tags	Bivalve net	Oyster tray	Mussel sheeting	Total	% of total litter
	Port des Canoge	2015	0	0	0	0	0	0
Slovenia	Belvedere – Bele skale	2014-2018	0.46 ± 0.76	18.41 ± 18.84	0	0	18.86 ± 18.85	3.74
	Debeli rtic	2013-2018	0	5.04 ± 7.08	0	0	5.04 ± 7.08	1.61
	Fiesa	2014-2018	0	60.80 ± 68.48	0	0	60.80 ± 68.48	3.64
	Koper – Zusterna	2017	0	1.40	0	0	1.40	0.67
	Mesecev zaliv	2013-2017	0.90 ± 2.01	5.46 ± 5.45	0	0	6.36 ± 5.81	5.54
	Piran	2013-2018	0	8.60 ± 7.65	0	0	8.60 ± 7.65	5.37
	Rt Ronek - Strunjan	2014-2019	0.11 ± 0.28	11.67 ± 11.32	0	0	11.78 ± 3.01	2.54
	Seca – Lucija	2014-2017	0	0	0	0	0	0
	Seca – Soline	2014-2017	0	0.09 ± 0.09	0	0	0.09 ± 0.09	0.16
	Simonov zaliv	2017	0	1.83	0	0	1.83	0.20
	Strunjan – Soline	2014-2017	0.16 ± 0.16	3.07 ± 0.29	0	0	3.23 ± 0.33	1.76
Tunisia	Raoued	2014	0	0	0	0	0	0
Turkey	Camlibel	2014	0	0	0	0	0	0

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Annex 5: Published quantities of aquaculture related debris.

Overview of the 'published quantities of aquaculture related debris'. This table is divided into general (A), and specific (B), and is sorted alphabetically by country. Every record is clarified by location, period, item specification with the linking litter inventory number (see Annex 1), published quantity, litter source, fate, relative share of aquaculture litter, and a reference. For more details, see Table 2.

Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	3.3	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Rope, string and nets	A01, A03	Plastic				Aquaculture / fisheries		Seabed	1.2	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Fish boxes	A11-A12	Plastic				Aquaculture / fisheries		Sea surface	11.4	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Fish boxes	A11-A12	Plastic				Aquaculture / fisheries		Sea surface	12.5	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea		2014 - 2016	Fish boxes	A11-A12	Plastic				Aquaculture / fisheries		Sea surface	10	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea		2014 - 2016	Fish boxes	A11-A12	Plastic				Aquaculture / fisheries		Sea surface	2.5	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Strapping bands	A17	Plastic				Aquaculture / fisheries		Seabed	0.8	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Albania	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Albania	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Levantine Sea	Cyprus	2013	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Fishing nets	A04	Plastic				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Crates / containers	A10, B13	Plastic				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Strapping bands	A15	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Cable ties	A17	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Boots	A20	Rubber				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Drums	A30	Metal				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Levantine Sea	Cyprus	2013	Bobbins	A31	Plastic, rubber				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2006 - 2015	EPS fish boxes	A13	Plastic				Aquaculture / fisheries		Sea surface	9.5	Di-Meglio et al., 2017

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic				Aquaculture / fisheries		Sea surface	20	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2007	EPS fish boxes	A13	Plastic	0.02		Items / km²	Aquaculture / fisheries		Sea surface	0.177936	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2007	EPS fish boxes	A13	Plastic	0.88		Items / km²	Aquaculture / fisheries		Sea surface	3.671256	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2007	EPS fish boxes	A13	Plastic	0.37		Items / km²	Aquaculture / fisheries		Sea surface	50	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2007	EPS fish boxes	A13	Plastic	0		Items / km²	Aquaculture / fisheries		Sea surface	0	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2007	EPS fish boxes	A13	Plastic	0		Items / km²	Aquaculture / fisheries		Sea surface	0	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2007	EPS fish boxes	A13	Plastic	0.34		Items / km²	Aquaculture / fisheries		Sea surface	2.726544	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	0.28		Items / km²	Aquaculture / fisheries		Sea surface	1.226456	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	1.21		Items / km²	Aquaculture / fisheries		Sea surface	7.311178	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	0.47		Items / km²	Aquaculture / fisheries		Sea surface	6.225166	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	0.18		Items / km²	Aquaculture / fisheries		Sea surface	1.228669	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	0.12		Items / km²	Aquaculture / fisheries		Sea surface	1.5625	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	0.26		Items / km²	Aquaculture / fisheries		Sea surface	1.108742	Di-Meglio et al., 2017
Mediterranean Sea	Ligurian Sea and Gulf of Lion	France	2008	EPS fish boxes	A13	Plastic	0.35		Items / km²	Aquaculture / fisheries		Sea surface	2.547307	Di-Meglio et al., 2017

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Ionian Sea	Greece	2014 - 2015	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	9.5	Fortibuoni et al., 2019
Mediterranean Sea	Ionian Sea	Greece	2014 - 2015	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	6.5	Fortibuoni et al., 2019
Mediterranean Sea	Ionian Sea	Greece	2014 - 2015	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	17.2	Fortibuoni et al., 2019
Mediterranean Sea	Ionian Sea	Greece	2014 - 2015	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	9.6	Fortibuoni et al., 2019
Mediterranean Sea	Aegean Sea	Greece	2013	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	5.4	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	0.5	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Synthetic ropes	A01	Plastic				Aquaculture / fisheries		Seabed	0.2	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Natural rope	A02	Natural textile				Aquaculture / fisheries		Seabed	0.1	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Natural rope	A02	Natural textile				Aquaculture / fisheries		Seabed	0.2	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Natural rope	A02	Natural textile				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Natural rope	A02	Plastic				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Fishing nets	A04	Plastic				Aquaculture / fisheries		Seabed	3.9	Ioakeimidis et al., 2014

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Ionian Sea	Greece	2013	Fishing nets	A04	Plastic				Aquaculture / fisheries		Seabed	1.2	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Fishing nets	A04	Plastic				Aquaculture / fisheries		Seabed	0.5	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Crates / containers	A10, B13	Plastic				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Crates / containers	A10, B13	Plastic				Aquaculture / fisheries		Seabed	3.8	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Crates / containers	A10, B13	Plastic				Aquaculture / fisheries		Seabed	11	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Strapping bands	A15	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Strapping bands	A15	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Strapping bands	A15	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Cable ties	A17	Plastic				Aquaculture / general		Seabed	0.1	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Cable ties	A17	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Cable ties	A17	Plastic				Aquaculture / general		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Boots	A20	Rubber				Aquaculture / general		Seabed	0.03	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Boots	A20	Rubber				Aquaculture / general		Seabed	0.3	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Boots	A20	Rubber				Aquaculture / general		Seabed	0.2	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Drums	A30	Metal				Aquaculture / fisheries		Seabed	0	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Drums	A30	Metal				Aquaculture / general		Seabed	0.03	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Drums	A30	Metal				Aquaculture / general		Seabed	0.2	Ioakeimidis et al., 2014
Mediterranean Sea	Aegean Sea	Greece	2013	Bobbins	A31	Plastic, rubber				Aquaculture / fisheries		Seabed	0.03	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Bobbins	A31	Plastic, rubber				Aquaculture / fisheries		Seabed	0.2	Ioakeimidis et al., 2014
Mediterranean Sea	Ionian Sea	Greece	2013	Bobbins	A31	Plastic, rubber				Aquaculture / fisheries		Seabed	0.2	Ioakeimidis et al., 2014

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Tyrrhenian Sea	Italy	2013	Fishing ropes	A01-A03	Natural product, plastic	0.0023	0.0006	Items / m^2	Aquaculture / fisheries		Seabed	16.2	Cau et al., 2017
Mediterranean Sea	Tyrrhenian Sea	Italy	2013	Fishing nets	A04	Plastic	0.0058	0.0013	Items / m^2	Aquaculture / fisheries		Seabed	41.9	Cau et al., 2017
Mediterranean Sea	Tyrrhenian Sea	Italy	2016	Fishing and aquaculture nets	A04	Plastic				Aquaculture / fisheries		Beach	3.7	Addamo et al., 2017
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Filaments / Nets / sticks	A04	Plastic	0.0217	0.0127	Items / m^2	Aquaculture / fisheries		Beach	9	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Filaments / Nets / sticks	A04	Plastic	0.0096	0.0099	Items / m^2	Aquaculture / fisheries		Beach	3	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Filaments / Nets / sticks	A04	Plastic	0.0391	0.0186	Items / m^2	Aquaculture / fisheries		Beach	4	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Filaments / Nets / sticks	A04	Plastic	0.2194	0.2086	Items / m^2	Aquaculture / fisheries		Beach	15	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Filaments / Nets / sticks	A04	Plastic	0.2099	0.0924	Items / m^2	Aquaculture / fisheries		Beach	35	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Filaments / Nets / sticks	A04	Plastic	0.0999	0.0701	Items / m^2	Aquaculture / fisheries		Beach	14	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Containers	A10	Plastic	0.0059	0.0036	Items / m^2	Aquaculture / fisheries		Beach	2	Merlino et al., 2018

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GENERAL ITEMS														
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Containers	A10	Plastic	0.012	0.0128	Items / m²	Aquaculture / fisheries		Beach	4	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Containers	A10	Plastic	0.0197	0.0126	Items / m²	Aquaculture / fisheries		Beach	2	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Containers	A10	Plastic	0.0479	0.0299	Items / m²	Aquaculture / fisheries		Beach	3	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Containers	A10	Plastic	0.0083	0.0047	Items / m²	Aquaculture / fisheries		Beach	1	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Containers	A10	Plastic	0.0187	0.0127	Items / m²	Aquaculture / fisheries		Beach	3	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Bottles, as marker buoy	A28	Plastic	0.0047	0.0018	Items / m²	Aquaculture / general		Beach	2	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Bottles, as marker buoy	A28	Plastic	0.0043	0.0072	Items / m²	Aquaculture / general		Beach	1	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Bottles, as marker buoy	A28	Plastic	0.1014	0.1325	Items / m²	Aquaculture / general		Beach	10	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Bottles, as marker buoy	A28	Plastic	0.0231	0.0258	Items / m²	Aquaculture / general		Beach	2	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Bottles, as marker buoy	A28	Plastic	0.0051	0.0044	Items / m²	Aquaculture / general		Beach	1	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Bottles, as marker buoy	A28	Plastic	0.0277	0.0343	Items / m²	Aquaculture / general		Beach	4	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Caps	A29	Plastic	0.0115	0.009	Items / m²	Aquaculture / general		Beach	5	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Caps	A29	Plastic	0.0077	0.0137	Items / m²	Aquaculture / general		Beach	2	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Caps	A29	Plastic	0.053	0.0888	Items / m²	Aquaculture / general		Beach	5	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Caps	A29	Plastic	0.1756	0.1384	Items / m²	Aquaculture / general		Beach	11	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Caps	A29	Plastic	0.0742	0.0199	Items / m²	Aquaculture / general		Beach	12	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Caps	A29	Plastic	0.0644	0.0539	Items / m²	Aquaculture / general		Beach	9	Merlino et al., 2018
Mediterranean Sea	Adriatic Sea	Italy	2015	Synthetic ropes	A01	Plastic	0.00065		Items / m²	Aquaculture / fisheries		Beach	0.539084	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Synthetic ropes	A01	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Synthetic ropes	A01	Plastic	0.00066		Items / m²	Aquaculture / fisheries		Beach	0.511509	Munari et al., 2015

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Adriatic Sea	Italy	2015	Synthetic ropes	A01	Plastic	0.00149		Items / m²	Aquaculture / fisheries		Beach	1.06383	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Synthetic ropes	A01	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Fishing nets	A04	Plastic	0.00097		Items / m²	Aquaculture / fisheries		Beach	0.808625	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Fishing nets	A04	Plastic	0.00349		Items / m²	Aquaculture / fisheries		Beach	0.612423	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Fishing nets	A04	Plastic	0.001		Items / m²	Aquaculture / fisheries		Beach	0.767263	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Fishing nets	A04	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Fishing nets	A04	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Buoys	A07	Plastic	0		Items / m²	Aquaculture / general		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Buoys	A07	Plastic	0.0015		Items / m²	Aquaculture / general		Beach	0.262467	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Buoys	A07	Plastic	0		Items / m²	Aquaculture / general		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Buoys	A07	Plastic	0		Items / m²	Aquaculture / general		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Buoys	A07	Plastic	0.00051		Items / m²	Aquaculture / general		Beach	0.317460	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Crates	A10, B13	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Crates	A10, B13	Plastic	0.00549		Items / m²	Aquaculture / fisheries		Beach	0.96238	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Crates	A10, B13	Plastic	0.001		Items / m²	Aquaculture / fisheries		Beach	0.767263	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Crates	A10, B13	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Crates	A10, B13	Plastic	0		Items / m²	Aquaculture / fisheries		Beach	0	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Gloves	A18	Rubber, plastic	0.00065		Items / m²	Aquaculture / general		Beach	0.539084	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Gloves	A18	Rubber, plastic	0.00648		Items / m²	Aquaculture / general		Beach	1.137358	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Gloves	A18	Rubber, plastic	0		Items / m²	Aquaculture / general		Beach	0	Munari et al., 2015

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
Mediterranean Sea	Adriatic Sea	Italy	2015	Gloves	A18	Rubber, plastic	0.00099		Items / m^2	Aquaculture / general		Beach	0.70922	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Gloves	A18	Rubber, plastic	0.00051		Items / m^2	Aquaculture / general		Beach	0.317460	Munari et al., 2015
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Rope	A01, A03	Plastic	0.21176		Items / 100m	Aquaculture / general		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Plastic drums	A08	Plastic	0.27059		Items / 100m	Aquaculture / general		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	EPS fish boxes	A13	Plastic	0.31765		Items / 100m	Aquaculture / fisheries		Beach		Poeta et al 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Strapping bands	A15	Plastic	0.64706		Items / 100m	Aquaculture / general		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Jerry cans	A27	Plastic	0.22353		Items / 100m	Aquaculture / general		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Western Basin	Italy	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Western Basin	Italy	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016	Fish boxes	A11-A12	Plastic				Aquaculture / fisheries		Sea surface	11	Vlachogianni et al., 2017

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
GENERAL ITEMS														
North Sea		Norway	2014	Rope	A01-A03	Natural product, plastic	32154		Number of items	Aquaculture / fisheries		Beach		Blidberg et al., 2015
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
North Sea	Skagerrak & Kattegat	Sweden	2014	Rope	A01-A03	Natural product, plastic	446		Number of items	Aquaculture / fisheries		Beach		Blidberg et al., 2015
Mediterranean Sea	Aegean Sea	Turkey	2017 - 2018	String and cord	A03	Plastic, nat. text.				Aquaculture / fisheries		Beach	1.6	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Turkey	2017 - 2018	Buoys	A07	Plastic				Aquaculture / fisheries		Beach	1.3	Vlachogianni, 2019
North East Atlantic	North East Atlantic	UK	2014	Polystyrene buoys	A07	Plastic				Aquaculture	All waste		0.02	Sherrington et al., 2016

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
SPECIFIC ITEMS														
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Mussel nets, Oyster nets	B02	Plastic	9.5333		Items / 100m	Aquaculture		Beach	2.43	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2015	Mussel nets, Oyster nets	B02, B06	Plastic				Aquaculture		Seabed	6	Fortibuoni et al., 2019
Mediterranean Sea	Adriatic Sea			Mussel and oyster nets	B02	Plastic				Aquaculture	All waste	Beach and seabed	30	Veiga et al., 2016
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016	Mussel nets, Oyster nets	B02	Plastic				Aquaculture		Seabed	8.4	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Albania	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2015	Mussel nets, Oyster nets	B02, B06	Plastic				Aquaculture		Seabed	12.9	Fortibuoni et al., 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2015	Mussel nets, Oyster nets	B02, B06	Plastic				Aquaculture		Seabed	54.1	Fortibuoni et al., 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2015	Mussel nets, Oyster nets	B02, B06	Plastic				Aquaculture		Seabed	15.8	Fortibuoni et al., 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2015	Mussel nets, Oyster nets	B02, B06	Plastic				Aquaculture		Seabed	12.5	Fortibuoni et al., 2019
Mediterranean Sea	Adriatic Sea	Italy	2015	Mussel socks	B06	Plastic	0.72		kg	Aquaculture		Seabed		Riccato et al., 2016
Mediterranean Sea	Adriatic Sea	Italy	2016	Mussel socks	B06	Plastic	4.94		kg	Aquaculture		Seabed		Riccato et al., 2016
Mediterranean Sea	Adriatic Sea	Italy	2016	Mussel socks	B06	Plastic	1.65		kg	Aquaculture		Seabed		Riccato et al., 2016
Mediterranean Sea	Adriatic Sea	Italy	2015	Mussel socks	B06	Plastic	0.63		kg	Aquaculture		Seabed		Riccato et al., 2016
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2015	Mussel nets	B02	Plastic	3.64		Items / 100m²	Aquaculture		Seabed	16	Melli et al., 2017

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
SPECIFIC ITEMS														
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Mussel nets	B02	Plastic	0.0152	0.0093	Items / m²	Aquaculture		Beach	6	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Mussel nets	B02	Plastic	0.0019	0.0032	Items / m²	Aquaculture		Beach	1	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Mussel nets	B02	Plastic	0.0296	0.013	Items / m²	Aquaculture		Beach	3	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Mussel nets	B02	Plastic	0		Items / m²	Aquaculture		Beach	0	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Mussel nets	B02	Plastic	0		Items / m²	Aquaculture		Beach	0	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	Mussel nets	B02	Plastic	0.0093	0.0051	Items / m²	Aquaculture		Beach	1	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	EPS	B08	Plastic	0.0354	0.0259	Items / m²	Aquaculture		Beach	15	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	EPS	B08	Plastic	0.1351	0.12	Items / m²	Aquaculture		Beach	43	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	EPS	B08	Plastic	0.6108	0.6077	Items / m²	Aquaculture		Beach	62	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	EPS	B08	Plastic	0.3836	0.311	Items / m²	Aquaculture		Beach	27	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	EPS	B08	Plastic	0.0453	0.0303	Items / m²	Aquaculture		Beach	7	Merlino et al., 2018
Mediterranean Sea	Ligurian Sea	Italy	2014 - 2016	EPS	B08	Plastic	0.242	0.219	Items / m²	Aquaculture		Beach	33	Merlino et al., 2018
Mediterranean Sea	Adriatic Sea	Italy	2015	Mesh bags	B04	Plastic	0.00259		Items / m²	Aquaculture		Beach	2.156334	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Mesh bags	B04	Plastic	0.05685		Items / m²	Aquaculture		Beach	9.973753	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Mesh bags	B04	Plastic	0.01031		Items / m²	Aquaculture		Beach	7.928389	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Mesh bags	B04	Plastic	0.00745		Items / m²	Aquaculture		Beach	5.319149	Munari et al., 2015
Mediterranean Sea	Adriatic Sea	Italy	2015	Mesh bags	B04	Plastic	0.0061		Items / m²	Aquaculture		Beach	3.809524	Munari et al., 2015
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Tags	B01	Plastic	0.12941		Items / 100m	Aquaculture / general		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Mussel nets, Oyster nets	B02	Plastic	1.54118		Items / 100m	Aquaculture		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Floats for fish nets	B08	Plastic	0.63529		Items / 100m	Aquaculture / fisheries		Beach		Poeta et al., 2016

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
SPECIFIC ITEMS														
Mediterranean Sea	Tyrrhenian Sea	Italy	2014 - 2015	Plastic sheeting	B11	Plastic	0.25882		Items / 100m	Aquaculture / general		Beach		Poeta et al., 2016
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Western Basin	Italy	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016	Mussel nets, Oyster nets	B02	Plastic				Aquaculture		Seabed	16.86	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Turkey	2017 - 2018	Mesh bags	B04	Plastic				Aquaculture / fisheries		Beach	5	Vlachogianni, 2019
WITHOUT ITEM REFERENCE														
EEA	EEA					Plastic	30,000		Tonnes (entire EEA)	Aquaculture	All waste			Sherrington et al., 2016
EEA	EEA						3,000 - 41,000		Tonnes / annum	Aquaculture	All waste			Sherrington et al., 2016
EEA	EEA						95,000 - 655,000		Tonnes (entire EEA)	Aquaculture	All waste			Sherrington et al., 2016

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
WITHOUT ITEM REFERENCE														
Mediterranean Sea	Northern and Central Adriatic Sea		2014							Aquaculture	All waste	Seabed	15	Pasquini et al., 2015
Mediterranean Sea	Northern and Central Adriatic Sea		2011 - 2012							Aquaculture	All waste	Seabed	17	Strafella et al., 2015
Mediterranean Sea	Adriatic and Ionian Sea		2014 - 2016							Aquaculture / fisheries	All waste	Seabed	17	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea		2014 - 2016							Aquaculture / fisheries	All waste	Seabed	5.7	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Albania	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Albania	2014 - 2016				8.9397	8.2775	Items / 100m	Aquaculture / fisheries	All waste	Beach	3.01	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Albania	2014 - 2016				4.6956	2.408	Items / 100m	Aquaculture / fisheries	All waste	Beach	3.01	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Albania	2014 - 2016				6.1404	1.9264	Items / 100m	Aquaculture / fisheries	All waste	Beach	3.01	Vlachogianni et al., 2017
North Sea	Southern North Sea	Belgium	2012							Aquaculture	All waste		3.05	De Vrees, 2011
Mediterranean Sea	Adriatic Sea	Bosnia - Herze-govina	2014 - 2016				3.86		Items / 100m	Aquaculture / fisheries	All waste	Beach	1.93	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Bosnia - Herze-govina	2014 - 2016				3.0494	0.6369	Items / 100m	Aquaculture / fisheries	All waste	Beach	1.93	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Bosnia - Herze-govina	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	2.7	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Croatia	2014 - 2016				368.335	134.1905	Items / 100m	Aquaculture / fisheries	All waste	Beach	3.49	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Croatia	2014 - 2016				14.2043	16.3681	Items / 100m	Aquaculture / fisheries	All waste	Beach	3.49	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Croatia	2014 - 2016				16.7171	15.1815	Items / 100m	Aquaculture / fisheries	All waste	Beach	3.49	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Croatia	2014 - 2016				7.47314		Items / 100m	Aquaculture / fisheries	All waste	Beach	3.49	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Croatia	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	15	Vlachogianni et al., 2017
Mediterranean Sea	Gulf of Lion	France	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
WITHOUT ITEM REFERENCE														
Mediterranean Sea	Gulf of Lion	France	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018							Aquaculture / fisheries	All waste	Beach	17	Vlachogianni, 2019
Mediterranean Sea	Gulf of Lion	France	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018							Aquaculture / fisheries	All waste	Beach	21	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Greece	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				12.892	7.9696	Items / 100m	Aquaculture / fisheries	All waste	Beach	11.72	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				49.9272	46.0596	Items / 100m	Aquaculture / fisheries	All waste	Beach	11.72	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				9.8448	11.0168	Items / 100m	Aquaculture / fisheries	All waste	Beach	11.72	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				32.3472	18.752	Items / 100m	Aquaculture / fisheries	All waste	Beach	11.72	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				19.4552	9.6104	Items / 100m	Aquaculture / fisheries	All waste	Beach	11.72	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				10.7824	5.5084	Items / 100m	Aquaculture / fisheries	All waste	Beach	11.72	Vlachogianni et al., 2017
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				28.5968		Items / 100m	Aquaculture / fisheries	All waste	Beach	8.1	Prevenios et al., 2018
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				53.326		Items / 100m	Aquaculture / fisheries	All waste	Beach	4.6	Prevenios et al., 2018
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				18.166		Items / 100m	Aquaculture / fisheries	All waste	Beach	9.2	Prevenios et al., 2018
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016				20.7444		Items / 100m	Aquaculture / fisheries	All waste	Beach	10.2	Prevenios et al., 2018
Mediterranean Sea	Ionian Sea	Greece	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	15.7	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2015				4.3		Items / 100m²	Aquaculture	All waste	Seabed	18.9	Melli et al., 2017
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
WITHOUT ITEM REFERENCE														
Mediterranean Sea	Tyrrhenian Sea	Italy	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Western Basin	Italy	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Gulf of Gabes	Italy	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				75.3777	49.5653	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				35.0115	23.341	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				14.5538	6.865	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				51.4875	35.8353	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				37.8948	13.4554	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				39.1305	48.055	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016				30.3433	20.4577	Items / 100m	Aquaculture / fisheries	All waste	Beach	13.73	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Italy	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	20.7	Vlachogianni et al., 2017
Baltic Sea	Gulf of Riga	Latvia	2012							Aquaculture	All waste		0	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Monte-negro	2014 - 2016				5.0828	3.1719	Items / 100m	Aquaculture / fisheries	All waste	Beach	0.97	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Monte-negro	2014 - 2016				2.1825	1.4356	Items / 100m	Aquaculture / fisheries	All waste	Beach	0.97	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Monte-negro	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	5.1	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Monte-negro	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	4.9	Vlachogianni et al., 2017
North Sea	Norwegian waters	Norway				Plastic	13,500		Tonnes / annum	Aquaculture	All waste			Sherrington et al., 2016
North Sea	Norwegian waters	Norway				Plastic	2		Tonnes per employee	Aquaculture	All waste			Sherrington et al., 2016

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Sea basin	Sea / waters	Country	Year(s) of observation	Item	Litter inventory no.	Material	Quantity	Standard deviation	Unit	Litter source	Group of items	Fate	% of total litter	Reference
WITHOUT ITEM REFERENCE														
North Sea	Norwegian waters	Norway				Plastic	11		kg per tonne of output production	Aquaculture	All waste			Sherrington et al., 2016
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Slove-nia	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Adriatic Sea	Slove – nia	2014 - 2016				33.32	1.9691	Items / 100m	Aquaculture / fisheries	All waste	Beach	6.8	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Slove – nia	2014 - 2016				11.356	2.992	Items / 100m	Aquaculture / fisheries	All waste	Beach	6.8	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Slove – nia	2014 - 2016				56.304	18.904	Items / 100m	Aquaculture / fisheries	All waste	Beach	6.8	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Slove-nia	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	14.3	Vlachogianni et al., 2017
Mediterranean Sea	Adriatic Sea	Slove-nia	2014 - 2016							Aquaculture / fisheries	All waste	Seabed	9.4	Vlachogianni et al., 2017
Mediterranean Sea	Balearic Sea	Spain	2012							Aquaculture	All waste		0	De Vrees, 2011
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Alboran Sea	Spain	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019
Mediterranean Sea	Balearic Sea	Spain	2017 - 2018							Aquaculture / fisheries	All waste	Beach	16	Vlachogianni, 2019
Mediterranean Sea	Aegean Sea	Turkey	2017 - 2018							Aquaculture / fisheries	All waste	Beach	10	Vlachogianni, 2019

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