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Pelagic fisheries of herring and sprat and Maritime Spatial Planning

Cross-border case study

ABSTRACT

Title: Pelagic fisheries of herring and sprat and Maritime Spatial Planning. Cross-border case study

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Abstract:

The aim of this report is to provide background information on the pelagic fisheries of Baltic herring (*Clupea harengus membras*) and Baltic sprat (*Sprattus sprattus balticum*) in the Plan4Blue project area, which includes the Gulf of Finland, the Archipelago Sea and parts of the southern Bothnian Sea.

This report also looks at how MSP can support the sustainable development of the fisheries sector. Key messages for the MSP process were drafted from the results of project workshops where the fisheries sectors views on MSP were brought forward by stakeholders and government officials.

Acknowledgements

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CONTENTS

1. INTRODUCTION

The Plan4Blue project conducted three cross-border case studies to study how cross-border aspects of the chosen topics could be taken into account in MSP. The cases were pelagic fishing, shipping and the Natura 2000 network. The pelagic fisheries of herring and sprat were chosen as the trawl fishing targeting them is a model example of a maritime livelihood with several cross-border aspects. The market for the catch is international and fishing vessels operate in the waters of several countries. Also the ownership of the fishing vessels has become transnational in recent years. Finally, the fish themselves move in large areas at sea crossing borders.

In autumn 2018 Plan4Blue project organised a stakeholder workshop to discuss future developments and drivers influencing the development of shipping and fishing sectors and the future developments that should be taken into account for addressing nature conservation in MSP. The workshop is reported in detail here.

Group works of the fishery case was organised in three sessions. The first session focused on identifying and analysing key drivers of the sector. The second session focused on scrutinising opportunities and challenges for reaching a sustainable state for pelagic fishing by 2030. Sustainability consists of environmental, economic and social elements. The last session discussed the next steps and the approach to finalise the case study.

This report presents our findings on pelagic fishing. The report begins with key recommendations on how pelagic fishing should be taken into account in MSP. The recommendations relate especially to what sort of information is important to consider in order for the MSP to support sustainable development and continuation of commercial fishing. The fisheries management system is described after the recommendations. An important perspective for addressing commercial fisheries in MSP is that the MSP itself does not directly regulate fishing activities which are regulated through a well-established fisheries management system that is legally stipulated as the EU's Common Fisheries Policy. The management measures control the effort, fishing technology as well as may set spatial restrictions on fishing activities. In both countries the MSP does address fishing, but with an intention to coordinate relations with other activities at sea and to protect the interests of the fishing sector.

Section 4 focuses on the biology of herring and sprat stocks and on their reproduction patters and areas. Section 5 focuses on fishing by presenting the fleet, locations of the important fishing grounds and landing sites. We describe also the basic features of fish markets and finalise with the drivers of fisheries that were discussed in a stakeholder workshop in 2018. The sections 4 and 5 presents examples of the types of information, maps and analyses referred to in the recommendations.

2. KEY MESSAGES FOR MARITIME SPATIAL PLANNING

Even though the MSP aims to influence fishing activities to the minimum extent, it can protect the interest of the fishing sector and, furthermore, spatial planning can have unintended consequences on fishing. The workshop in 2018 discussed different aspects of how the MSP can support fishing and to avoid unintended consequences on fishing. The discussion on how MSP could help in protection of the spawning areas raised the following points:

- Sprat spawns in open water areas, which means that the sprat does not have any specific spawning areas.
- The existing modelling on the potential spawning areas of herring indicates that almost all shallow water areas are potential spawning areas. It is important to (still) increase our knowledge on herring spawning areas. Where exactly are the herring spawning areas?
- In addition to spawning areas, it is important to know nursery areas and in general different areas for all life stages of fish.
- The concept of essential fish habitats should be utilised in MSP. Even then the most important areas should be identified to help planners to know which areas are especially critical for the fish stocks. All coastal areas or even all spawning areas cannot be protected.
- Research methods to identify the essential fish habitats for MSP include sampling and modelling as well as interviews of fishermen.
- The information of the essential fish habitats are usable for MSP processes in Estonia and Finland.
    - In Estonia the MSP process is relatively detailed where the information on the essential fish habitats can be used in planning as was shown in the Pärnu Bay MSP pilot.
    - In Finland MSP will be more general. In such a planning very detailed spatial information on essential fish habitats or spawning areas is not on the suitable scale. However, the important areas for the fish stocks can be included in the background documents that will be produced to support MSP in Finland. The background documents can include information on more detailed levels and they can also indicate which issues could be taken into account in lower level spatial planning in sea areas such as regional planning

The workshop also discussed on a broader scale what information is needed to take fisheries into account in MSP. This discussion produced the following two key messages for MSP.

Fishing grounds and routes to them should be included in the planning evidence of the MSP process

Such information is needed to ensure that planning decisions concerning other sea uses will not cause unnecessary harm to the fishing sector.

Specifications:

- Locations of intensive fishing effort and catch (expressed in tonnes and/or monetary value) will give good understanding of important fishing areas.
- There are several sub-sectors within fisheries. The MSP planning evidence should differentiate between different segments of fishery.
- The planning evidence should cover several years' time series with spatial specificity and also analyse annual changes as these may be considerable.
- Routes from fishing harbours to fishing grounds and back to landing sites should be part of the planning evidence to avoid unnecessary blocking of these routes.
- Pelagic fishing in cross-border activity in many respects: fishing, fish populations, ownership and regulation.

Certain areas are important for the spawning and different life stages of fish; it is important to take these areas into account in MSP

This information can generate planning decisions to protect areas important for the fish stocks.

Specifications:

- Some fish species may have very distinctive areas where they live in different life stages from spawning areas, to nursery areas and to feeding areas. Many fish have also annual migration patterns.
- Spawning and nursery areas, sometimes called essential fish habitats, can be protected from human disturbance by planning decisions or these areas can be indicated in MSP.

3. FISHERIES MANAGEMENT IN THE BALTIC SEA

Knowing the basic characteristics of fisheries management and its transnational organisation is important for MSP. Involvement of the fisheries sector administration in the process is a key element. Transnational nature of the fisheries management system should be utilised in cross-border collaboration in MSP.

Historically, the management of the Baltic Sea fisheries has been developing from national control to regional coordination. Until 2005 the Baltic fish resources were managed by the International Baltic Sea Fisheries Commission (ISBF) and currently as most Baltic Sea coastal states, apart from Russia, have joined the European Union their fisheries activities are being regulated by the EU Common Fisheries Policy (CFP). The Russian Federation and the EU signed an agreement in 2009 on cooperation in fisheries and the conservation of the living marine resources in the Baltic Sea.

The EU Common Fisheries Policy has been in effect as of 1983 and during this time it has been revised thrice with the latest revision in 2013. The CFP is a complex policy with an overall objective to ensure the economically, environmentally and socially sustainable use of fisheries resources. To achieve this the CFP sets rules, principles and concepts such as community waters, fishing licenses and permits, access to waters, fishing effort, vessel capacity, relative stability etc. The CFP also limits the possibilities of the member states on introducing national regulations on fisheries, but in the Baltic Sea this applies mostly to the pelagic fisheries while the coastal fisheries are still mainly regulated by each country through their national legislation.

Management of fisheries for herring and sprat are based on a multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea (Regulation (EU) 2016/1139). The scientific basis and advice for limiting the amount of herring and sprat that can be fished annually is given by the International Council for the Exploration of the Seas (ICES). The annual amount is given as a range of the annual catch to correspond with the annual plan. The assessment of the state of the stock and previous years' catches are taken into account.

Total Allowable Catches (TACs) and fishing quotas are defined annually for the commercially important fish stocks in the Baltic Sea including cod, herring, sprat, plaice and salmon. The International Council for the Exploration of the Sea (ICES) performs stock size assessments and proposes exploitation levels accordingly. The European Commission uses this information as the basis for their proposals for TACs and quotas. Stakeholder involvement by e.g. regional fisheries associations is achieved through the Baltic Sea Regional Advisory Council (BS-RAC) which gives their opinion on the EC proposals. The regulations are adopted by the EU Council and besides the annual TACs and quotas can also include other Baltic specific regulations such as technical measures including mesh sizes, minimum landing sizes and by-catch imitations as well as fishing closure periods and areas. The Estonian and Finnish TACs for Baltic herring and sprat are shown in figures 1 and 2.

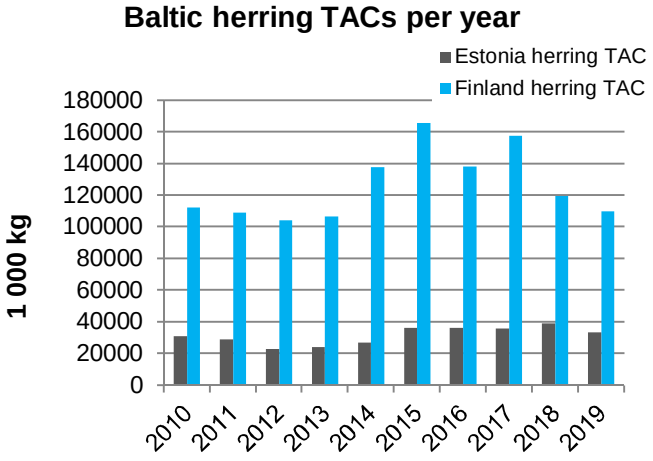


Figure 1. Finnish and Estonian TACs for Baltic herring, 2010–2019.

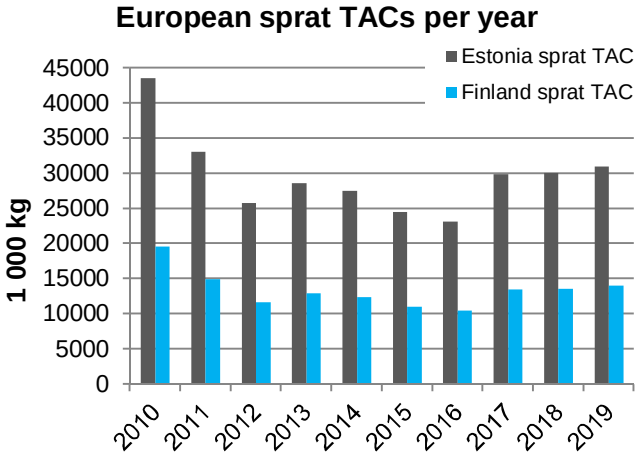


Figure 2. Finnish and Estonian TACs for Baltic sprat, 2010–2019.

The EU fisheries regulation allows allocation of national TAC to individual fishing right holders in a system of transferable individual quotas - ITQ. Finland has practiced such fisheries management in commercial herring, sprat and salmon fisheries since 2017. The initial allocation of quotas was based on the fishing history of those that applied for the ITQ. Three best years of a five-year period were taken into account. The system requires that the individual quota is used and reported. Otherwise it may be taken back to the state. From the initial quota allocation, 4% of the TAC was reserved as non-transferable quotas for newcomers (Hanstén 2019, 12).

The EU member states' fisheries control and inspection activities are coordinated by the European Fisheries Control Agency (EFCA) and are conducted by the member states through their national authorities and inspectors. The member states' control activities are monitored by EU Community inspectors to ensure rules are being followed in the national fisheries control systems that include inspections, enforcement and surveillance and data collection.

4. FISH STOCKS OF HERRING AND SPRAT

The state of the fish stocks is the key asset for commercial fisheries. The states are followed in a highly sophisticated system in the Baltic Sea area. This provides sound background information for MSP, as well. The most important commercial fish stocks typically cover large areas beyond national borders, which should be taken into account in MSP and cross-border collaboration.

Both the Baltic herring (*Clupea harengus membras*) and the Baltic sprat (*Sprattus sprattus balticus*) are a planktivory fish species that spend most of their time in pelagic areas, with herring an exception being their spawning in coastal areas while sprat spawn in the open part of the Baltic proper. The International Council for the Exploration of the Sea (ICES) Subdivisions of the Baltic Sea are presented in Figure 3. ICES classifies the herring in the Baltic sea into several stock units, of which the "Herring […] in subdivisions 25–29 and 32, excluding the Gulf of Riga" and the "Herring […] in subdivisions 30 and 31 (Gulf of Bothnia) are within the Plan4Blue project area. Sprat in the Baltic Sea is considered as one stock unit - the "Sprat […] in subdivisions 22-32".

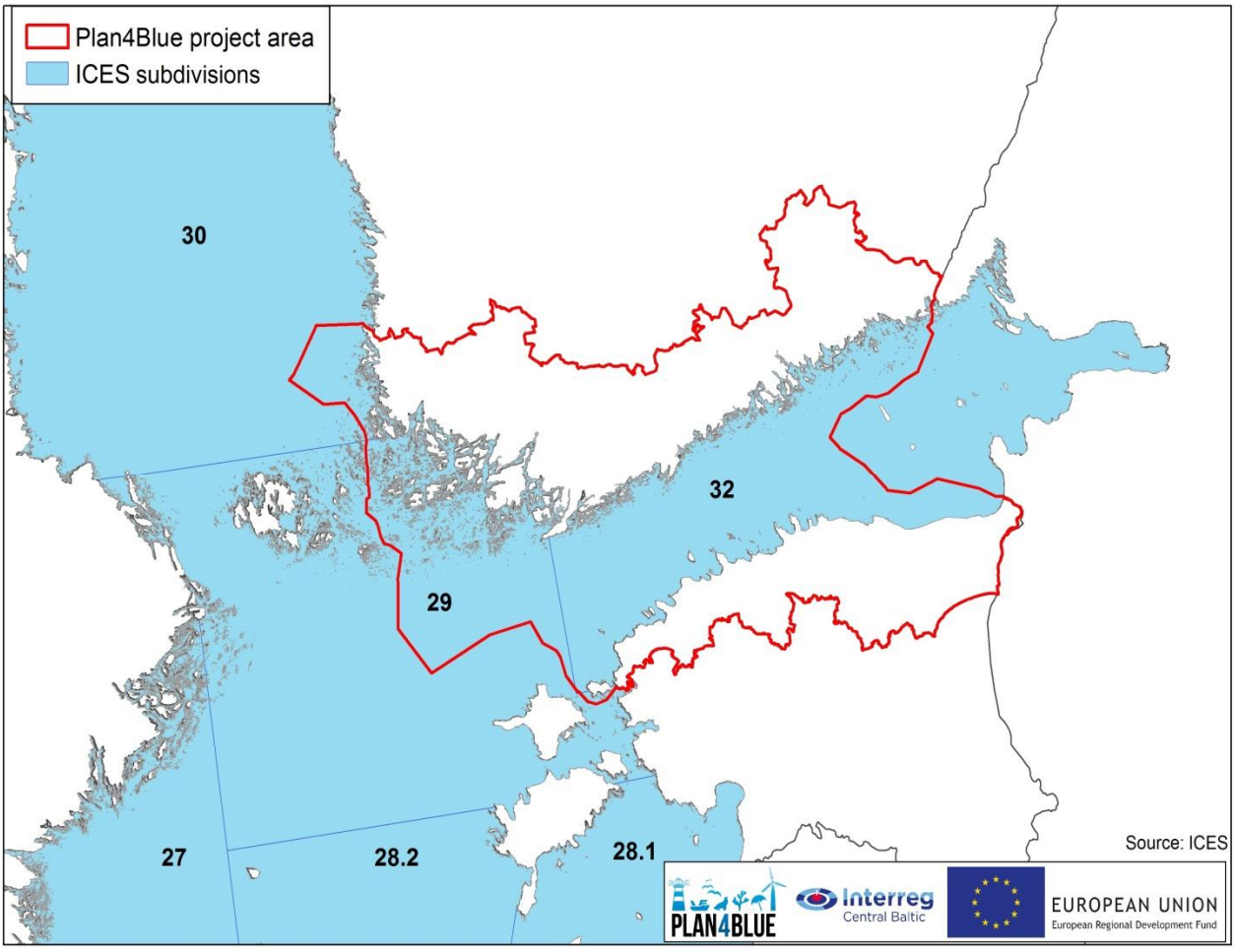


Figure 3. ICES Subdivisions of the Baltic Sea relevant for the pelagic fishery in the project area. The subdivisions 26 to 22 are located south and southwest from the ones shown on the map.

It should be noted that while this report focuses only on the Estonian-Finnish cross border fisheries issues, these fish stocks are also being utilized by other countries in the region. The Bothnian Sea herring stock is being fished by Sweden and Finland, while the central Baltic Sea herring stock and the Baltic Sea sprat stock are both being fished by Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. In this study we cover areas outside of the project area delineation, because fishing for chosen fish species takes

place in a large Baltic Sea area, especially the Bothnian Sea (ICES Subdivision 30) that is northwest from the project area is important (Figure 3).

4.1 State of the herring stocks

For herring in subdivisions 25–29 and 32 (excluding the Gulf of Riga) ICES advises (ICES, 2019) that when the EU multiannual plan (MAP) is applied, herring catches in 2020 that correspond to the MAP are between 130 546 tons and 214 553 tons.

Referring to the ICES Advice on fishing opportunities, catch, and effort (ICES, 2019) in the Baltic Sea ecoregion the spawning-stock biomass (SSB) of the Baltic herring has shown an increasing trend since 2001, and has been above maximum sustainable yield (MSY, Btrigger) since 2007 (Figure 4.1). Fishing mortality has shown an increasing trend since 2013 and has been above maximum rate of fishing mortality (the proportion of a fish stock caught and removed by fishing) FMSY since 2016. Recruitment in 2015 is estimated to be the highest of the whole time-series. In the last four years recruitment has been below or on average.

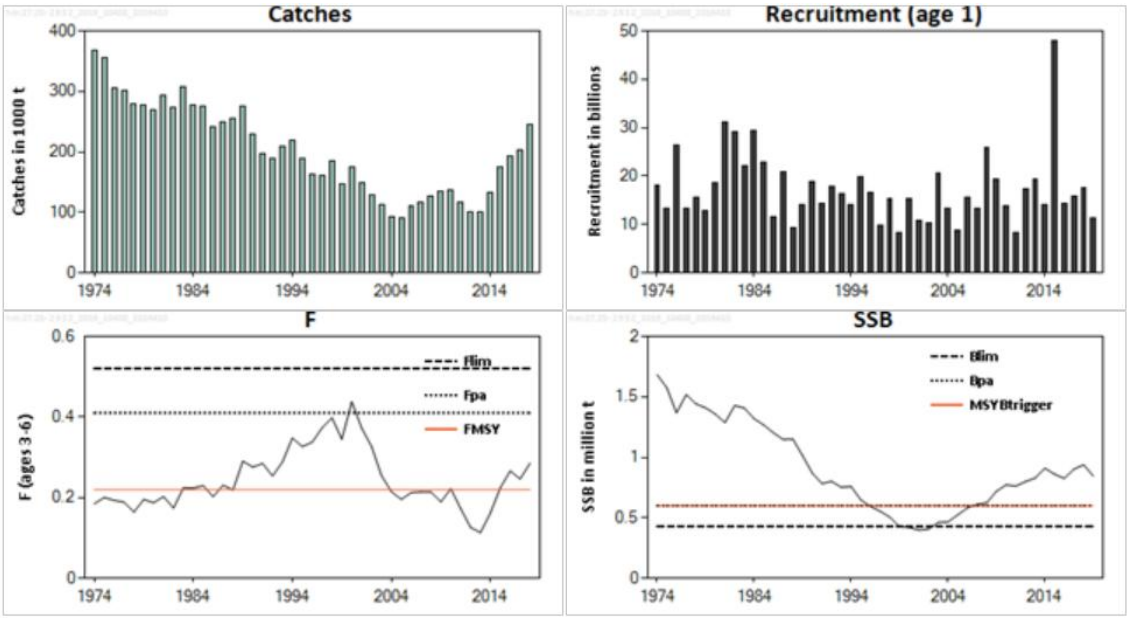


Figure 4.1, Summary of the stock assessment; the SSB value for 2019 is predicted. Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. (ICES, 2019).

For the Bothnian Sea, ICES subdivisions 30 and 31, ICES advises (ICES, 2019) that when the precautionary approach is applied, catches in 2020 should be no more than 65 018 tons (Figure 4.2). The relative spawning-stock biomass (SSB) has been decreasing in recent years. Recruitment shows an overall increasing trend. Fishing mortality (F) has shown an increasing trend since 2010, reaching a historical high in the last six years. This may not be sustainable.

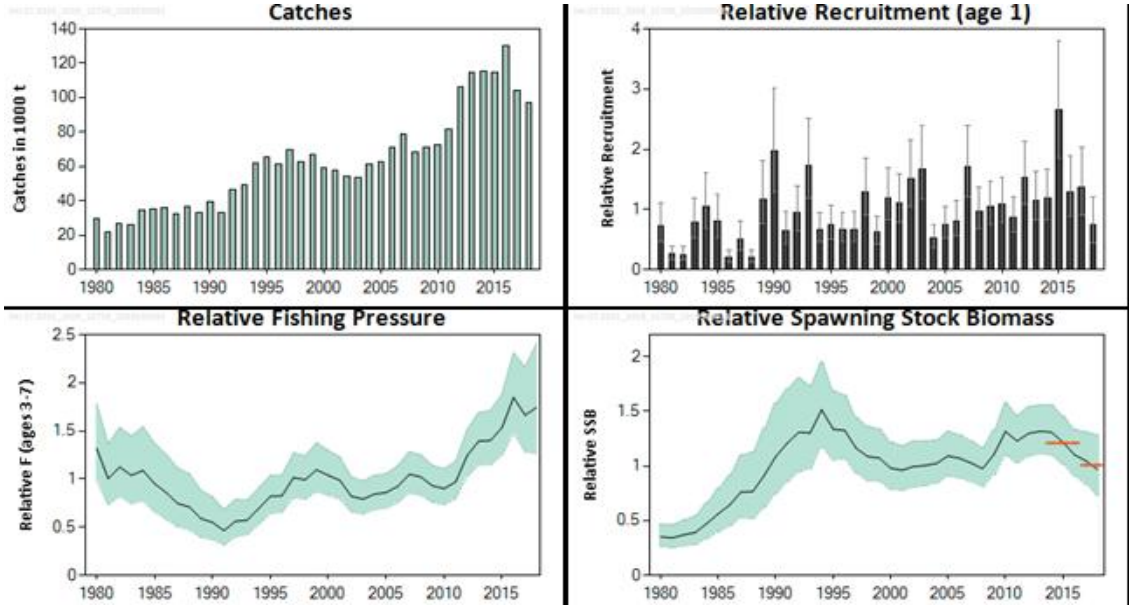


Figure 4.2, Summary of the stock assessment; Recruitment, F, and SSB are relative to the mean of the time-series. The dashed lines in the SSB plot indicate the average values of the respective years. Confidence intervals (95%) for recruitment, F, and SSB are shown in the plot. Herring in subdivisions 30–31. (ICES, 2019).

For herring in subdivisions 25–29 and 32 (excluding the Gulf of Riga) ICES assesses that fishing pressure on the stock is above FMSY but below precautionary level of fishing mortality (Fpa and Flim), while spawning stock size is above MSY (Btrigger, Bpa, and Blim) (Figure 5).

	Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019
Maximum sustainable yield	F_{MSY}	✗	✗	✗ Above	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{ranges}	✓	✓	✗ Above range	MSY $B_{trigger}$	✓	✓	✓ Above trigger

Figure 5. State of the stock and fishery relative to reference points. Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. (ICES, 2019).

For herring in the subdivisions 30 and 31 ICES cannot assess the stock and exploitation status relative to MSY and precautionary approach (PA) reference points because the reference points are undefined.

4.2 State of the sprat stock

ICES advises (ICES, 2019) that when the EU multiannual plan (MAP) is applied, catches in 2020 that correspond to the plan are between 169 965 tons and 233 704 tons. According to the MAP, catches higher than those corresponding to FMSY (225 786 tons) can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule.

It is stated (ICES, 2019) that the spawning-stock biomass (SSB) is well above MSY Btrigger (Figure 6). The recent increase in SSB is attributable to the strong year class of 2014. The 2015–2018 year classes are estimated at below or close to average. Fishing mortality (F) has declined but has remained above FMSY since 1994.

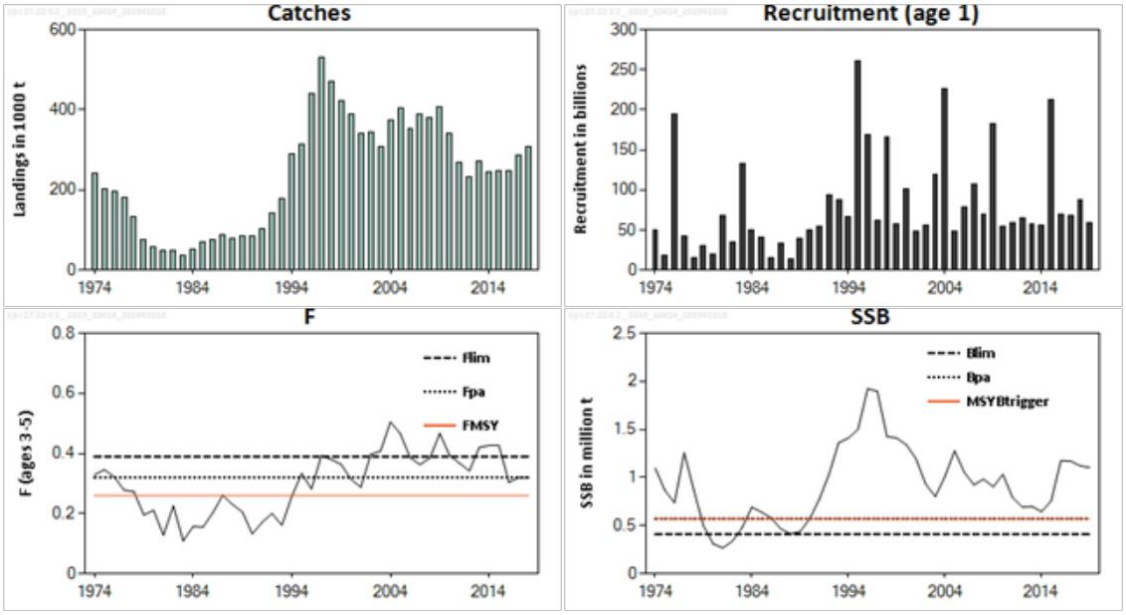


Figure 6. Sprat in subdivisions 22–32. Summary of the stock assessment. SSB at spawning time in 2019 is predicted (ICES, 2019).

According to ICES (ICES, 2019) the sprat spawning-stock biomass (SSB) is well above MSY Btrigger and the recent increase in SSB is due to the strong year class of 2014 (Figure 7). The 2015 and 2016 year classes are estimated slightly below average, while the 2017 year class is estimated to be above average and the fishing mortality (F) has declined in recent years to just above FMSY.

	Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019
Maximum sustainable yield	F_{MSY}	✗	✗	✗ Above	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MSY} ranges	✗	✗	✗ Above	MSY $B_{trigger}$	✓	✓	✓ Above trigger

Figure 7. Sprat in subdivisions 22–32. State of the stock and fishery relative to reference points (ICES, 2019).

4.3 Spawning areas and essential fish habitats

Some fish species are dependent on particular areas in different life stages. This is a spatial aspect that can be taken into account in MSP, for instance, by protecting important spawning and nursery areas in planning decisions. Areas important for different life stages of commercial fish species can be located in the planning area of neighbouring countries when protection of them becomes a transnational issue. In recent years more and more information has become available on these important areas and new analytical methods such as Essential Fish Habitats method have been introduced.

Herring and sprat spawning areas are very different. Whereas the herring spawns in shallow water areas the sprat spawns in open water areas when the exact locations of sprat spawning vary substantially. In this section we focus on herring spawning areas.

The suitability of coastal waters to herring spawning is modelled in both countries. In Estonia the modelling result is given on a range from high to low value (Figure 8), whereas in Finland the modelling results are presented in three categories: very favourable, favourable, unfavourable (Figure 9).

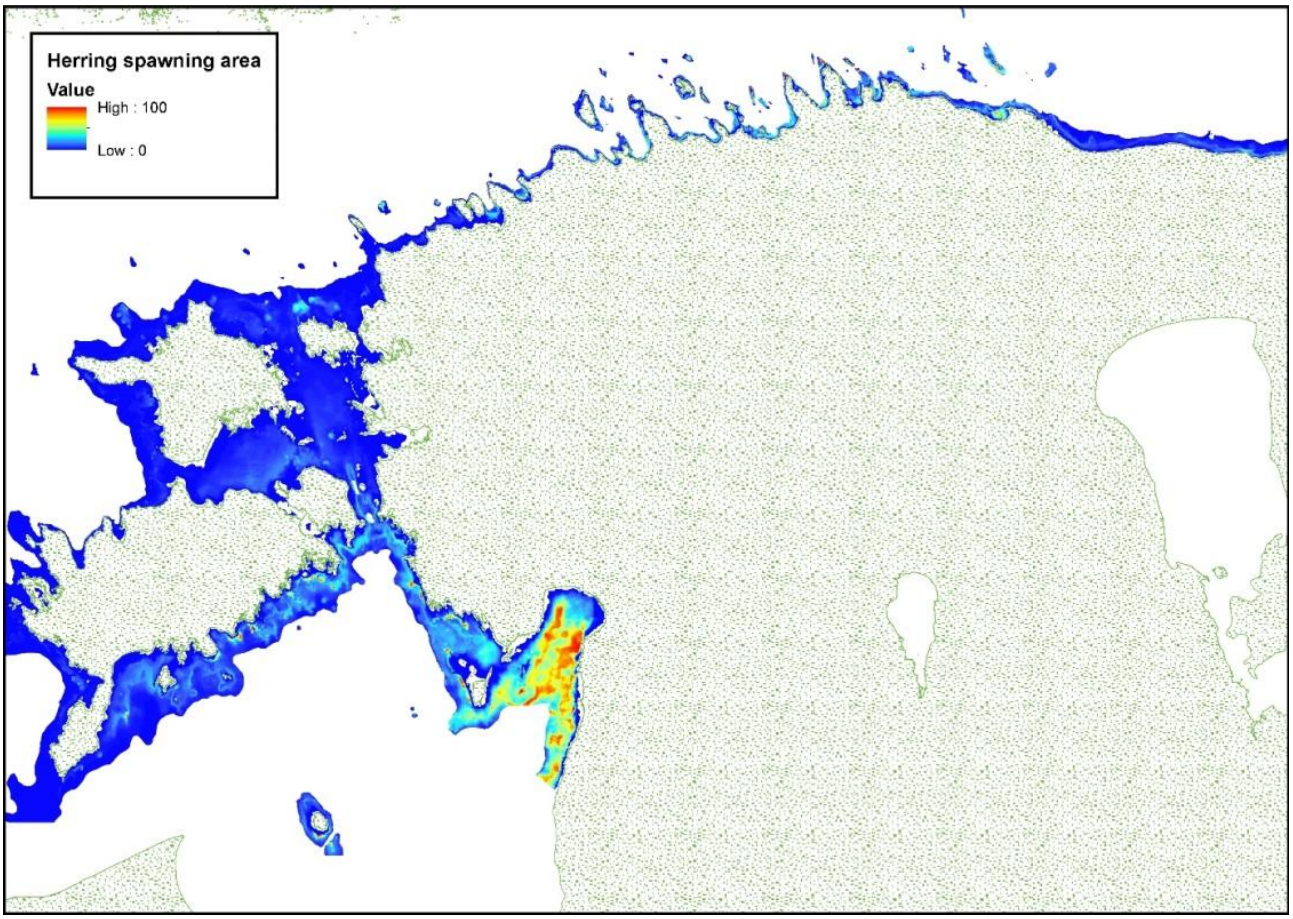


Figure 8. The Baltic herring spawning area in the marine waters under Estonian jurisdiction.

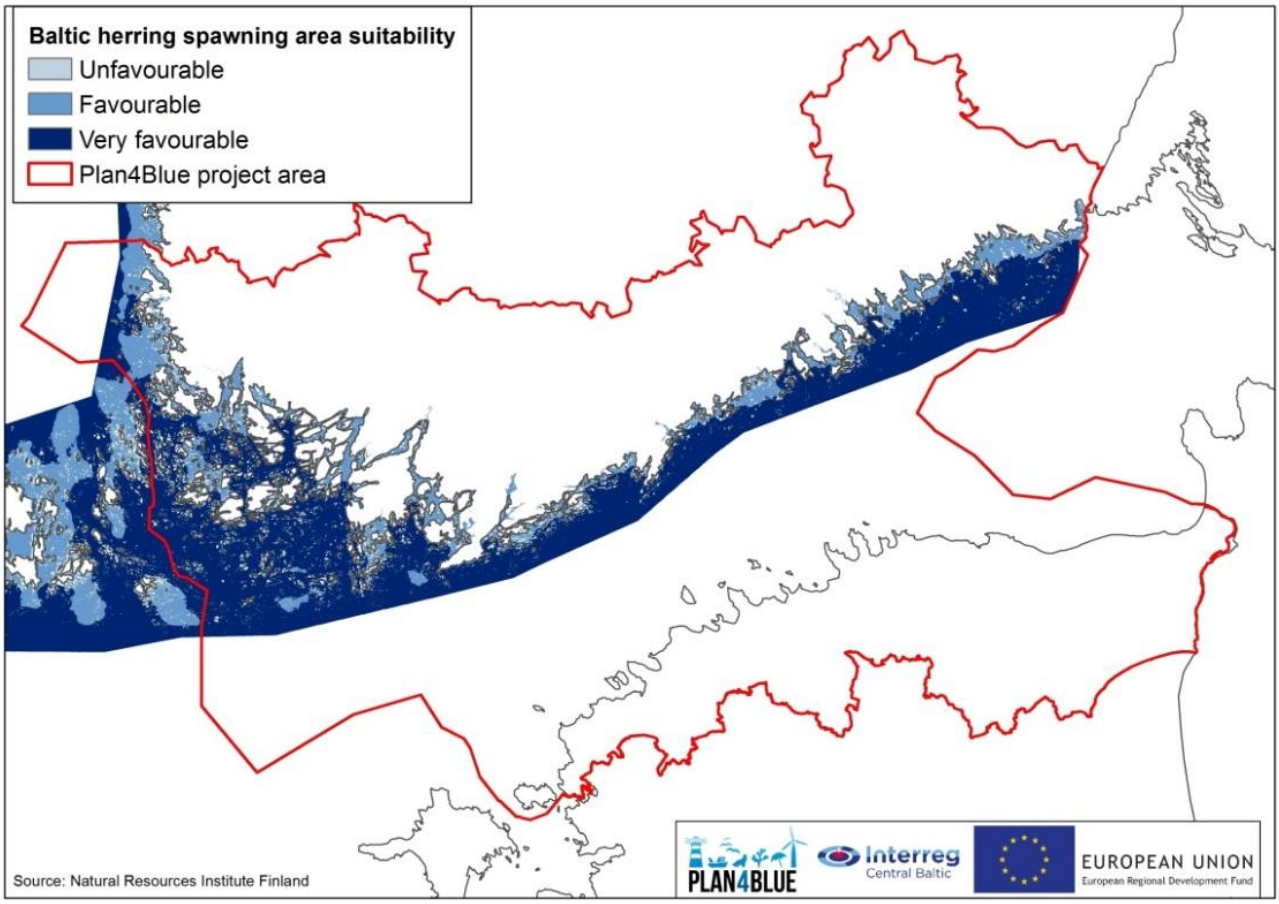


Figure 9. Suitability of coastal water areas for herring spawning in the Finnish waters. The result is based on modelling. Source: Natural Resources Institute Finland.

The assessment of suitability of coastal waters for spawning of herring is one approach to present important areas for the recruitment of the stock. Another, more comprehensive approach that is being introduced also to the Baltic Sea is called the assessment of essential fish habitats.

The Essential Fish Habitat (EFH) which is described as a subset of all habitats occupied by a species, and is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (NOAA, 1998). „Waters“ are defined to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, „substrate“ to include sediment, hard bottom, structures underlying the waters, and associated biological communities while „necessary“ means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem.

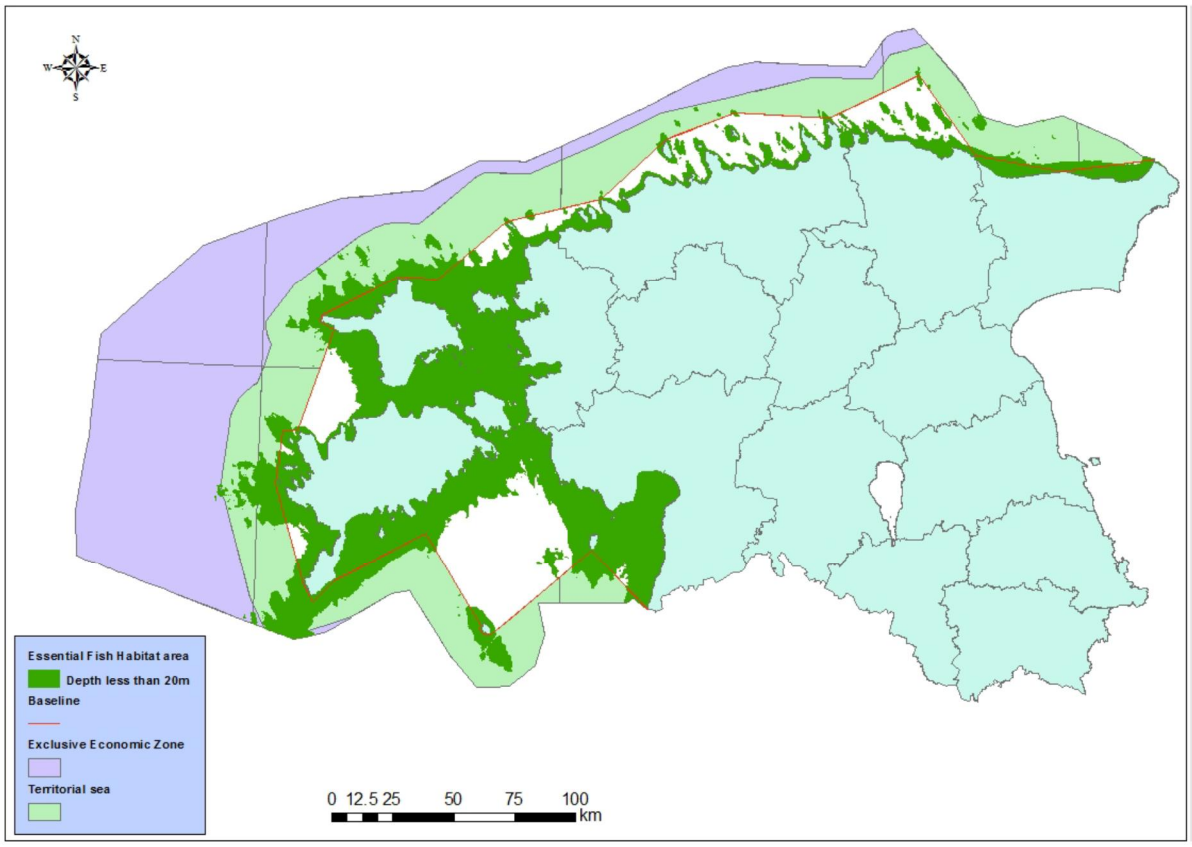


Figure 10 Essential Fish Habitat potential sea area in the waters under Estonian jurisdiction (depth less than 20 m).

5. HERRING AND SPRAT FISHERIES IN FINLAND AND ESTONIA

MSP is planning locations for different human activities at sea. Even if fisheries is seldom influenced directly by MSP plans, which is also the case in Finland and Estonia, planning decisions may have unintended consequences on fishing activities. Planning process should use information on important fishing grounds where fishing takes place, but also on landing sites routes used by fishing boats between the harbours and fishing grounds. Spatial information on fishing activities and amounts of catches are key elements in the existing fisheries management system. There is also data available on movements of fishing vessels and landing sites. The available data shows that commercial fishing is often transnational activity.

Information of the structures and trends as well as drivers of fish markets is also important background information for MSP, even if it was not presented in spatial formats.

5.1 Fishing fleets

The EU member states' fishing capacity is managed through the Common Fisheries Policy. A fishing fleet maximum capacity ceiling is established for each member state, both in gross tonnage (GT) and kilowatts (kW). Removal of existing fleet capacity is required to allow new fishing vessels into the fleet, and through this 'entry-exit' system Europe's fleet capacity can no longer increase. Member states are required to report annually on their fleet to the EU Commission, which maintains the EU fleet register with the reported vessel information.

The Finnish marine fishing fleet fishes within the Baltic Sea and is divided nationally into two operational vessel categories, offshore and coastal vessels. The vessels in the offshore category are at least 12 metres long in total, the largest currently being 41 metres, and the vessels in the coastal category are under 12 metres long in total. Offshore vessels use pelagic trawls, bottom trawls and passive gear mostly to fish herring and sprat, with some of them also fishing cod and salmon. The coastal vessels are mainly used to fish non-quota species of the coastal fish stocks, such as whitefish, pike-perch, pike and perch with coastal fishing of quota species targeting herring and salmon. These national vessel categories do not restrict either the right to use certain types of fishing gear or target species and the ship-owner can choose to switch to another type by informing the authorities of changes to the registered data. The offshore vessels are capable of switching between target species, fishing cod/herring/sprat depending on availability and price.

According to the fleet capacity report of 2017, Finland has 52 offshore fishing vessels (8719 GT / 20414 kW) and 3172 coastal vessels (7735 GT / 144321 kW). Since 2003 the amount of offshore vessels has decreased by 56% and the amount of coastal vessels by 28% while the gross tonnage has decreased 8% for offshore and 26% for coastal vessels. The decrease in offshore vessels is mostly accounted for the drift net fishing ban coming into force in 2008, with a total of 1675 GT of capacity being removed using public financial support in 2004–2009. At the end of year 2017 the Finnish fishing fleet was 1612 GT (9%) and 6982 kW (4%) below the defined fleet capacity ceiling (18066 GT / 174735 kW).

In the last 15 years a significant proportion of the Finnish offshore fishing fleet has been sold to Swedish and Estonian companies operating in the fisheries industry. Buying Finnish companies operating Finnish fishing vessels has provided these foreign companies a way to increase their allowed catch by using the Finnish quota allocated to vessels registered in Finland.

The Estonian marine fishing fleet is divided nationally based on overall length, fishing gear, main target species and fishing grounds into the Baltic Sea trawling segment, high seas fishery segment and coastal segment. The Baltic Sea trawling segment consists of ships of 12 metres or longer and the coastal segment of vessels less than 12 metres in length, so in general these two categories are somewhat comparable to the Finnish offshore and coastal vessels while the high seas segment does not exist in Finland.

According to the fleet capacity report of 2017, Estonia has 32 Baltic Sea trawling vessels (3519 GT / 8946 kW) and 1557 coastal vessels (2215 GT / 22340 kW). The Baltic Sea trawling vessels are used for fishing sprat and

herring in the Baltic Sea as compared to earlier years, cod fishing has lost its importance because cod stocks are in decline and fishing is not profitable due to the cod fishing grounds being farther away. Vessels that were used for cod fishing have turned to fishing sprat and herring, or have been removed from the fleet. Since Estonia joined the EU in 2004, the number of vessels has increased but both the gross tonnage and engine power have decreased considerably as larger trawling vessels have been removed from the fleet and replaced by smaller coastal fishing vessels. This is reported to be to better adjust to smaller fishing opportunities and to ensure profitability. In 2006–2014 a total of 60 vessels were removed from the Estonian Baltic Sea trawling fleet using public financial aid. At the end of year 2017 the Estonian fishing fleet (including the high seas fleet) was 7243 GT (34%) and 6879 kW (13%) below the allowed maximum fleet ceiling (21329 GT / 51850 kW).

5.2 Fishing grounds and landing sites

The abundance of the fish stocks is not the only factor determining which fishing grounds are being utilized as the fishing operators have to factor in costs of the fishing effort versus the value of the catch. Distance of the fishing grounds from the vessels' home port and the landing sites plays a major role in the determination of the costs - longer trips use more fuel and take more time adding up in labour costs. An example of fishing effort in the project area is shown in the figure 11. The figures 12 and 13 below) show from which ICES statistical rectangles herring and sprat landings were from (coastal fishing is included in the landing figures). It is worth noting that even though Baltic herring populations exist both in the Bothnian Sea and Gulf of Finland, most of the landings in the time period observed were from the Southern Bothnian Sea. The range of distribution for Baltic sprat does not include the Bothnian Sea.

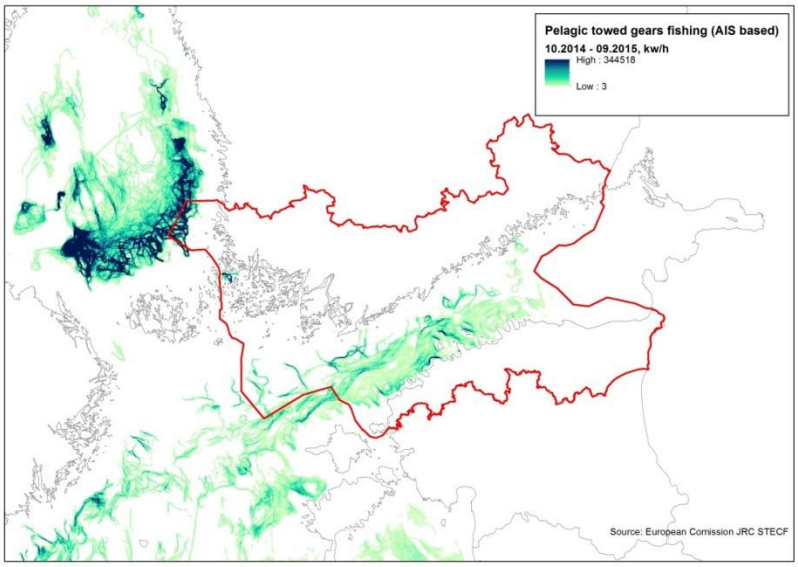
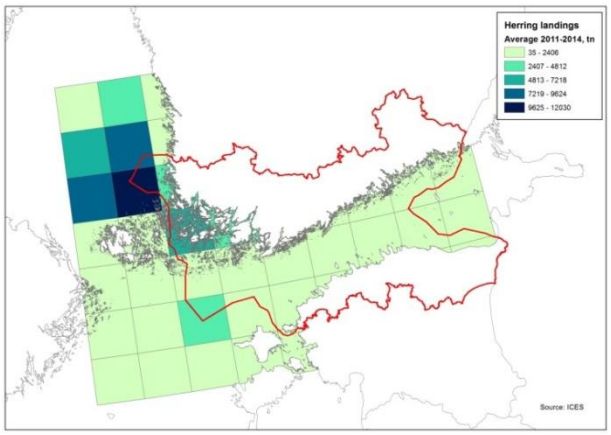
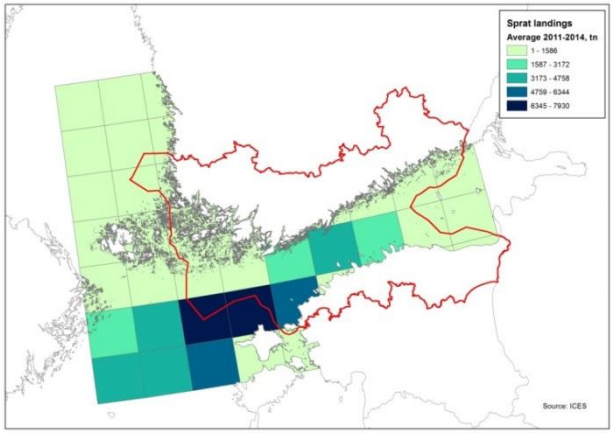


Figure 11. Pelagic towed gear fishing (AIS based) in and around the project area (Oct 2014 – Sep 2015).



Map 12. Herring landings (tn) in and around the project area (2011 – 2015).



Map 13. Sprat landings (tn) in and around the project area (2011 – 2015).

During trawl fishing the vessels operate with slower speed and have limited manoeuvrability, needing to take to take into account other maritime traffic. Figure 14 shows how fishing vessels routes overlap other maritime traffic in the project area.

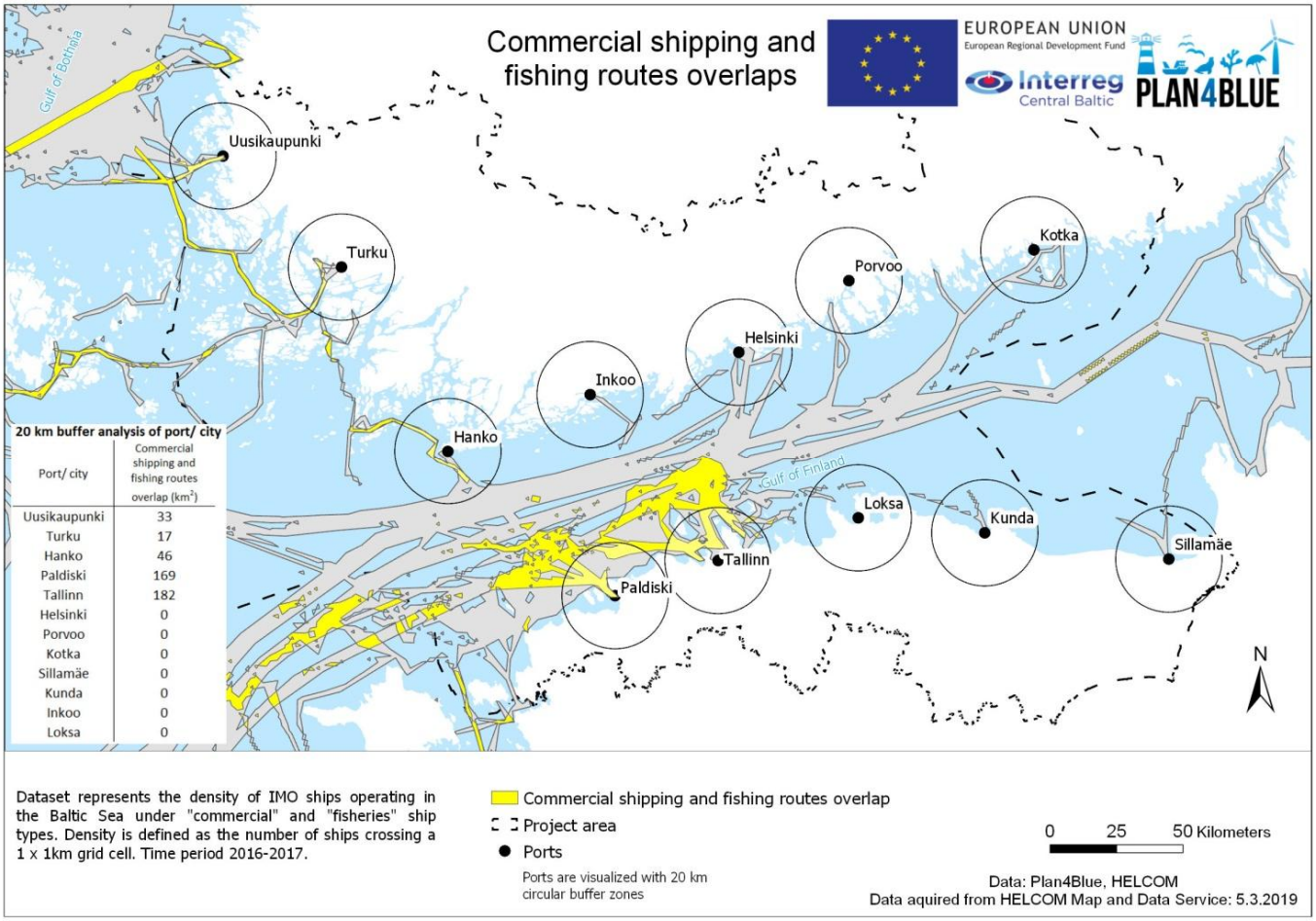


Figure 14. Overlap of fishing vessel routes with other shipping activity. (figure by Meeli Roose/University of Turku; source: HELCOM Map and Data Service)

Fishing ports are important infrastructure elements of the land-sea functional connection that are enabling the landing of the pelagic trawl catches of the Baltic herring and sprat according to EU and the national regulations (Figure 15).

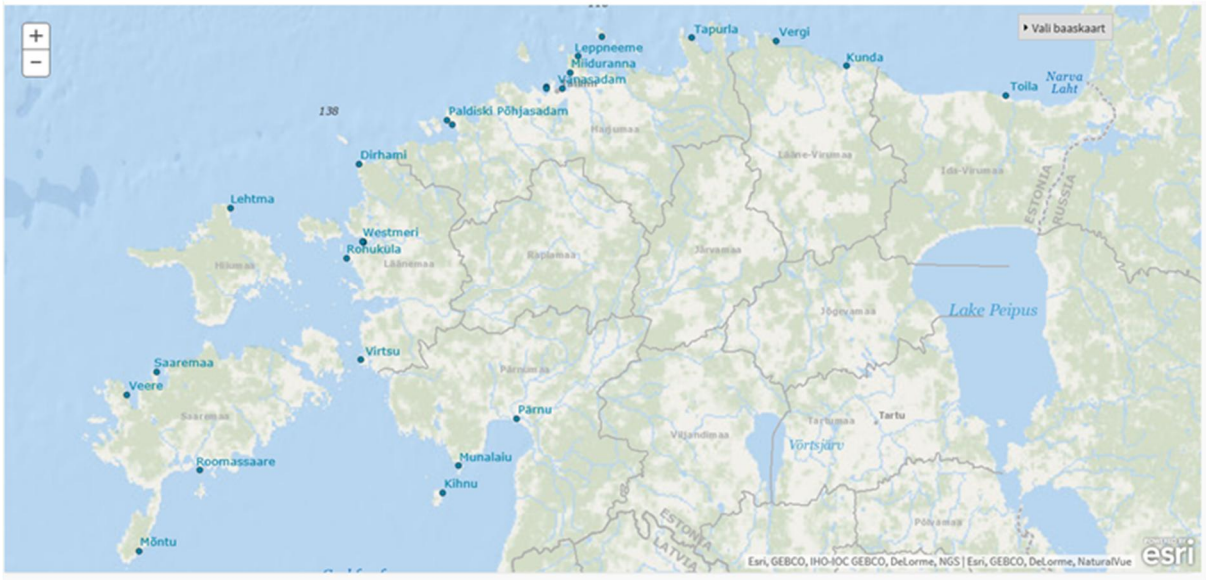


Figure 15. Estonian fishing ports enabling the landing of the pelagic trawl catches of the Baltic herring and sprat according to EU and the national regulations on 'First-sale fish' fish from a Union vessel which is offered for sale for the first time.

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According to EU fishing quota allocation conditions and agreements Estonian trawl fishers are fishing also in the Central and Southern Baltic and they are landing the catches in the fishing ports of Latvia, Lithuania, Poland, Denmark and Sweden as well.

Finnish landing sites in and near the project area are shown in Figure 16. Sites include private and public (municipal) fishing ports and the dataset contains all types of fish landing sites, not just the ones suitable for trawlers.

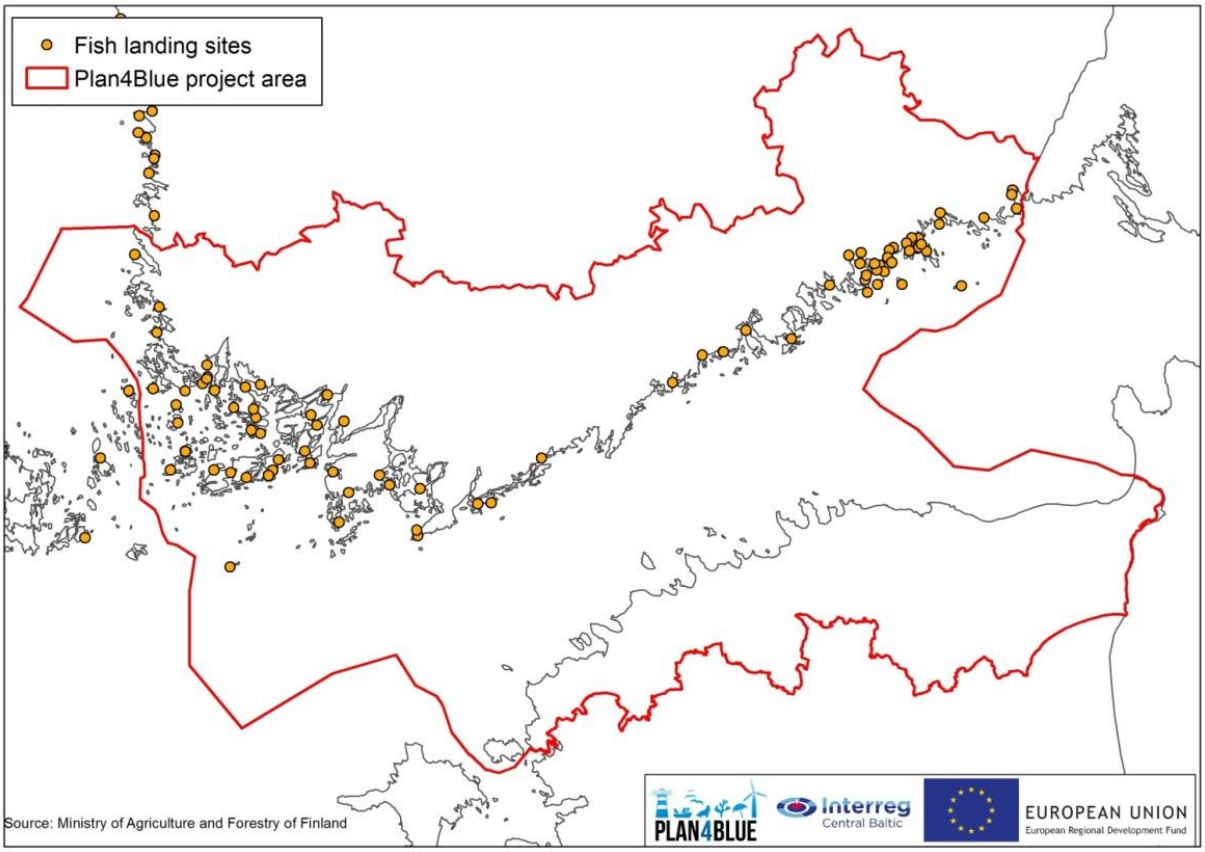

Figure 16. Commercial fishing landing sites in Finland.

5.3 Catches and Market

In both countries the catches of herring and sprat form the bulk of the commercial fish catch. Table 1 presents the catches of herring and sprat in 2018 reported by Estonian vessels and the table 2 the similar information regarding Finland's fisheries.

Table 1. The Estonian catches of the Baltic herring and sprat by ICES Subdivisions 27-32 in 2018 (Source: Estonian Ministry of Rural Affairs, https://www.agri.ee/en/objectives-activities/fishing-industry-and-commercial-fishing/catch-data).

Fish species	27	28-1	28-2	29	32	Total, t
Sprat	285	133	3933	11430	13845	**29626**
Herring	411	5607	2386	6706	11553	**26663**
Total, t	696	5740	6319	18136	25398	

Table 2. The Finnish catches of the Baltic herring and sprat by ICES subdivisions 27-32 in 2018 (Source: Natural Resources Institute Finland, link to the statistics

Fish species	27 and 28	29	30	31	32	Total, t
Sprat	4065	7044	2012	11	3323	**16455**
Herring	9850	28113	79041	2098	7385	**126487**
Total, t	**13915**	**35157**	**81053**	**2109**	**10708**	

The market for fish and fish products in the Baltic Sea area has changed drastically in the past 40 years, both due to changes in consumer preferences and the globalization of markets in general. For example, in the 1980s, 80% of the Finnish herring catch was sold domestically for food, but in 2017 domestic food consumption amounted to only 3% of the herring and sprat catch (Figure 17), whereas nearly 80% of all fish products consumed in Finland is made of Norwegian sea-farmed salmon.

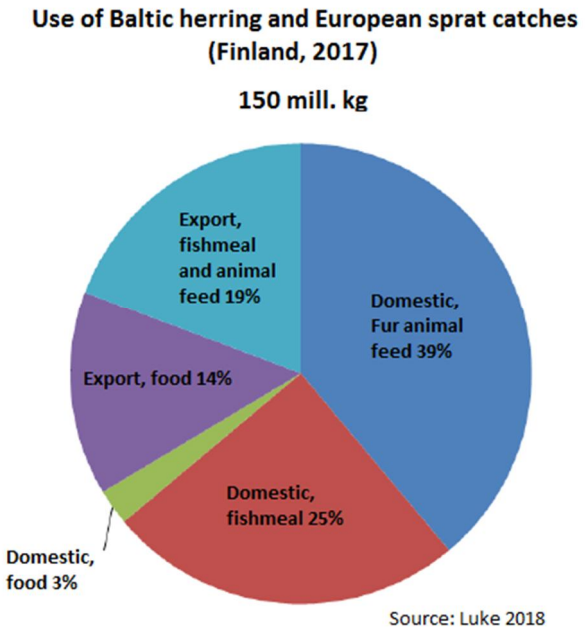

Figure 17. Use of the Baltic herring and sprat catches (Finland, 2017).

Figures 18 and 19 present the destinations of export of herring and sprat from Finland during the period 2011–2016. The Russian Federation was a major export country until 2014 when certain types of food imports from the EU were restricted. This practically stopped the export of frozen herring (~10 million kg pa) and sprat to Russia. Other types of foods such as fish preserves have not been included in the restrictions and their export has continued. During this period exports to Denmark for production of fishmeal have increased until 2016, but in 2017 both the exports to Denmark and landings to Sweden (supplying Danish factories) have been 50% lower as the Danish fishmeal industry has been able to acquire fish from their domestic supply.

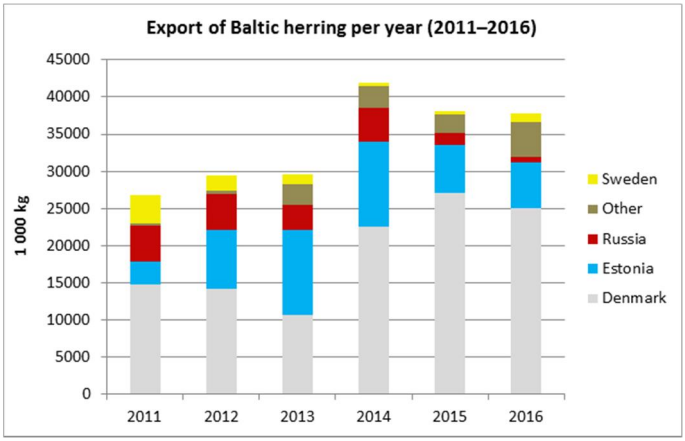

Figure 18. Export of Baltic herring from Finland in 2011–2016.

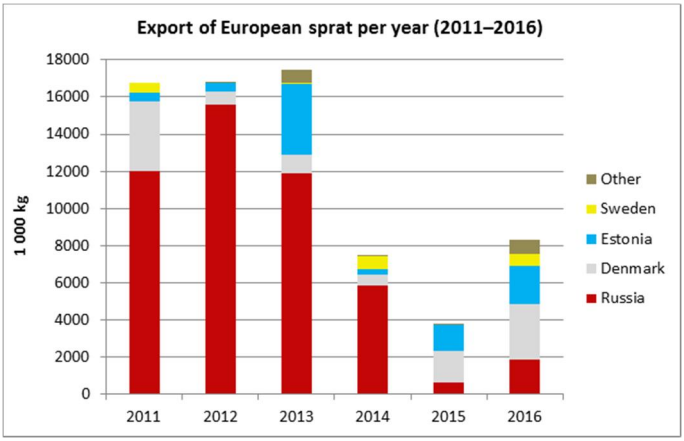

Figure 19. Export of European sprat from Finland in 2011–2016.

It is also worth noting that while the figures 16 and 17 show the total amount of fish exported, there is a significant difference in the prices paid for fish landings intended for different uses (Table 3). For example, herring caught for human consumption fetches the best price but the market for it is small and the fish need to be of certain size and quality. In comparison, fish intended for fur animal feed are not as valued and can be stored longer in the ship tanks before being processed, allowing for longer times at sea and in transit to landing sites.

Table 3. Landing prices reported from Finland 2017. Source: Natural Resources Institute Finland

Destination	Use	Price (eur/kg)
Direct landings to Sweden	Fishmeal or fur industry feed	0.09-0.12
Domestic	Fur industry feed	0.14-0.18
Export	(Herring or sprat, use not specified)	0.15-0.25
Domestic	Fishmeal	0.16-0.20
Domestic	Herring fillet	0.25-0.75

As the fisheries products market is nowadays globalized, it is also constantly changing as new sources of demand appear while old ones wither. The domestic food consumption of Baltic herring is not as significant part of the market anymore, and in the future the demand for fur animal feed might diminish too as several countries in the region, such as Denmark and Sweden, have already enforced restrictions on fur production, effectively phasing out the whole industry – as of yet there are no such plans in Finland but this might change in the long run. Another currently important part of the market, fishmeal production, is a globalized and highly competed sector where the high seas fisheries are utilized as raw material. Globally the EU produces only approximately 10% of all fishmeal and of this the Baltic Sea produce is but a small fraction. However, due to growing demand of aquaculture products the demand of fishmeal, used as raw material for fish feed, is on the rise. The opening of new fishmeal factories in Estonia and Finland in recent years has shown that adapting to new market conditions is possible.

Also Estonia is exporting large volumes of fish. The figure 20 presents the export fresh, chilled or frozen Baltic sprat and herring in 2013–2017.

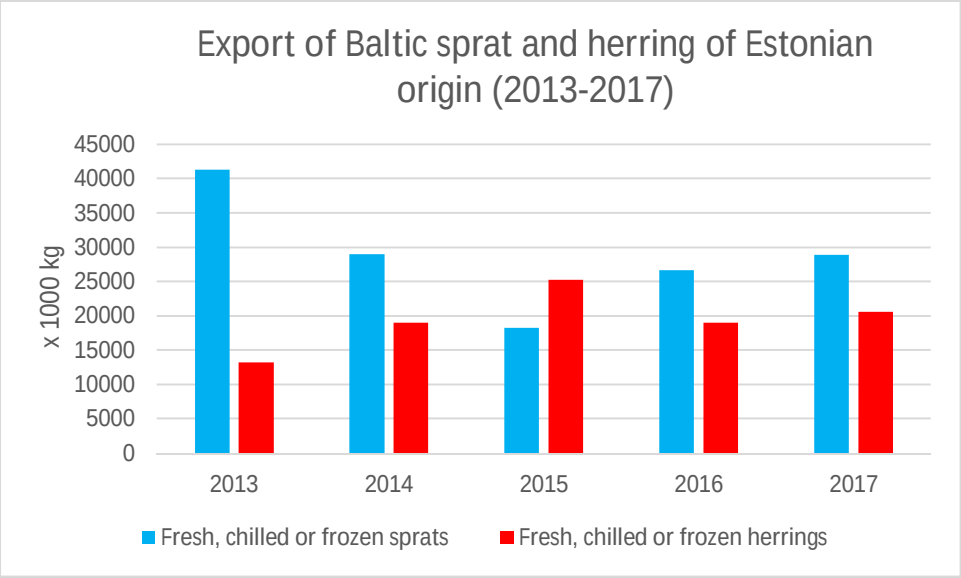

Figure 20. Export volumes of Estonian origin fresh, chilled or frozen Baltic sprat and herring in 2013-2017 (Source: Statistics Estonia http://pub.stat.ee/px-web.2001/dialog/statfile1.asp).

5.4 Drivers of fisheries

In autumn 2018 Plan4Blue project organised a stakeholder workshop to discuss future developments and drivers influencing the development of shipping and fishing sectors and the future developments that should be taken into account for addressing nature conservation in MSP (see section 1. Introduction).

Results of the session to identify and analyse key drivers of the sector are summarised here. The group that consisted of fisheries experts from Estonia and Finland identified the following key drivers that influence development of pelagic fishing.

The following table (Table 4) shows the groups of drivers in the order of their importance.

Table 4. The key drivers of the development of pelagic fishing

Key drivers	Comment
Global market development	Refers to large scale dynamics of demand for fish products and to trade politics
State of the ecosystem	Overall state of the Baltic Sea ecosystem that influence fish stocks. The state of the sea has importance also to usability of the fish for human consumption (pollutants)
State of the fish stocks	The fish stocks is the basis for fishery. It is directly linked to political decisions on fishing quotas.
Costs of fishing	The costs are influenced by many factors, e.g. fuel prices, tax systems and also by the subsidies
Consumer behaviour	Smaller scale market dynamics, impacts also the price of fish (consumer behaviour can be influenced by national actions, e.g. campaigns, MSC certificate)
Innovations in fish products	New products for the consumers, but also to industrial use
Concentration of capital	Concentration of quotas, where to find investors?
Fishing technology development	Influences cost of fishing and is linked to new developments in the market

An analysis of the key drivers in terms of their importance and likelihood to become influential by 2030 produced the following result (figure 21)

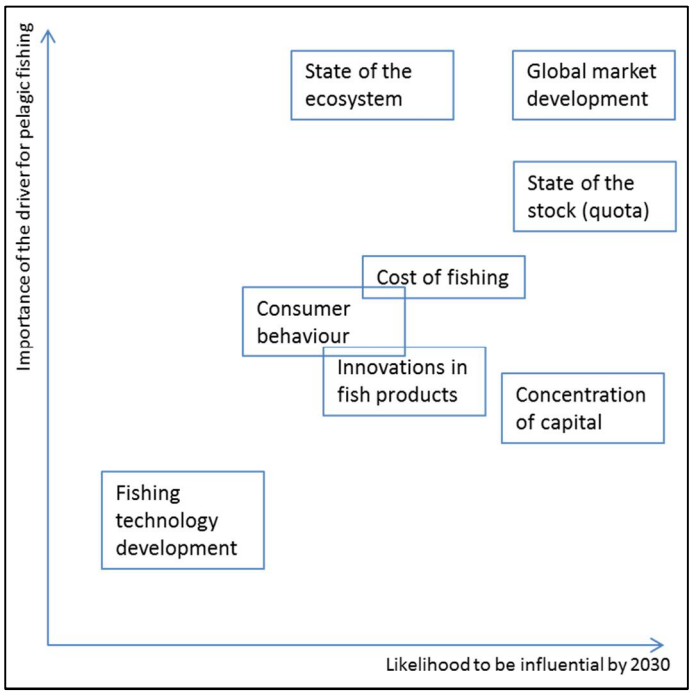

Figure 21. A result of the analysis of key drivers

The analysis of the drivers indicated that there are three especially important drivers:

1. Global market development influences pelagic fishing in the region since the fishery operates in truly international markets. Previously a large share of the fish that was sold for human consumption went to the Russian market which is now closed due to trade restrictions. This makes the fishery dependent on trade politics and geo-political developments. The largest share of herring and sprat catches in Finland are sold to fur industry. Global demand of fur is thus an indirect, but important driver also of the pelagic fishery.

2. State of the ecosystem was also identified as one of the most important drivers. It influences the state of the fish stock – also one of the most important drivers – but has also consequences on the possibility of selling Baltic Sea fish to the markets. Level of dioxins in the fish is an important factor that was mentioned. Changes in the state of the ecosystem were conceived as rather slow development. Therefore, it was seen as not to become very influential by 2030. Currently, any dramatic changes are not foreseen and, for instance, the climate change that is an important factor influencing the state of the ecosystem will not produce significate changes by 2030.

3. The state of the fish stocks that is directly influencing the fishing quotas is an important factor. It was also seen in the group work as a factor that continues to be very relevant by 2030 8more than the state of the ecosystem). The state of the fish stocks influences how much fish can be caught, which makes it very important, but still the market development was seen as a more important driver to the development of pelagic fishing.

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