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Policy coherence for ecosystem-based management: Implementing EU water and marine policies in the Archipelago Sea

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ABSTRACT

The European Union (EU) Water Framework Directive (WFD) and Marine Strategic Framework Directive (MSFD) call for member states to achieve the good environmental status of coastal waters and marine areas and to create ecosystem-based management plans that cover individual sectors. The Baltic Marine Environment Protection Commission (HELCOM) has listed the Archipelago Sea as an environmental hotspot in the Baltic Sea due to its vulnerability to the impacts of eutrophication. Agricultural runoff is the main source of excess nutrient loading, although aquaculture, tourism, wastewater treatment and internal loading also contribute. In this paper, we focus on the horizontal and vertical policy coherence in the Archipelago Sea region. The research data consist of policy documents and 11 thematic interviews. This paper aims to reveal how European water and marine policies are implemented in the Archipelago Sea and to identify the synergies and coherence challenges exist between policy sectors of agriculture, aquaculture and offshore wind. Evidence from the Archipelago Sea case study shows that a lack of coherence between sectoral policies can create challenges for ecosystem-based management. Moreover, the coherence and synergies in implementing regional and EU marine policy frameworks at the national and local levels can guide sectoral decisions towards strengthening of marine resilience and biodiversity.

1. Introduction

Eutrophication is the greatest environmental challenge in the Baltic Sea region, caused by nutrient pollution, with agriculture being the main source [1–4]. Climate change is predicted to increase internal pressures, further exacerbating eutrophication in the Archipelago Sea and posing challenges to the governance system of the Baltic Sea [5,6]. The primary governance challenge in the Baltic Sea basin is the lack of efficient policy tools to manage riverine loads from agriculture.

To achieve healthy marine ecosystems, the EU Commission has undertaken the task of streamlining policies to manage the marine environment in a more holistic way [7]. The EU Water Framework Directive (WFD), Marine Strategic Framework Directive (MSFD) and Marine Spatial Planning Directive (MSPD) call for member states to create ecosystem- and area-based management plans that cover individual sectors [8–11]. Also, the HELCOM implement the ecosystem-based management, which is multi-scale, place-based and locally designed [12]. There are multiple benefits of ecosystem-based management, such as addressing cumulative impacts, delivering ecosystem benefits and services and enhancing adaptive management [13–15].

The ecosystem-based management approach can bring stakeholders and rights together for envisioning a desired future with measurable goals, building, or strengthening capacity, co-producing knowledge, co-innovating solutions, and practicing adaptive management [13]. The WFD introduces ecosystem-based management, which runs in a cyclical planning process with water management plans updated every six years and set binding legal obligations, which hinder the authorisation of activities that contradict the objectives of the WFD [16–19]. The MSFD establishes a similar process, requiring member states to develop national marine strategies to achieve good environmental status and maintain healthy, productive and resilient marine ecosystems [20]. The MSPD aims to establish marine spatial plans that need to be updated every ten years. The plans provide strategic guidance for the development of industries and activities in river basins and regional seas. The directives endorse the ecosystem-based management as they require member states to develop programmes of measures to achieve objectives such as good ecological and chemical status. These directives share the objectives of improved and systematic data across the EU, stakeholder engagement and cross-border co-operation.

In this paper, we study the policy coherence, which has been defined

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as an element of policy that aims at reducing conflicts and promoting synergies between two or more policy areas or within a singular policy area to efficiently achieve jointly agreed policy objectives [21–26]. We study policy coherence of environmental policies and regulation aimed at mitigating nutrient load in the Baltic Sea, alongside other policy sectors such as agricultural policy, aquaculture, and offshore wind power. To assess and understand the degree of (in)coherence [27] in policy and legal landscapes, we study policy coherence on multiple governance scales. Scholars of EU policy implementation have often focused on the concern of whether the actions of policy stakeholders that implement the policy conform to the policy [28,29]. In alignment with this, we also test the coherence of how well one policy conforms with the objectives of another. Policy coherence is therefore expected to lead to more efficient implementation of environmental policy mixes, although its evaluation depends on the time horizon and the objectives considered.

We focus on the Archipelago Sea as a representative case for a coherence analysis between sectoral policies. We study the coherence and incoherence of the ecosystem-based water and marine management policies and sectoral policies, which may exist at both horizontal and vertical levels. The focus of this study is on the horizontal coherence of the different sectors identified: agriculture, aquaculture and offshore wind power. The main aim of this paper is to study the implementation major European water and marine policies and to analyse policy coherence from the perspective of challenges and synergies. Since EU directives are implemented at the national and regional levels, we focus our study on one geographical area: the Archipelago Sea in southwest Finland. We address the coherence of nutrient mitigation policies through their main functions and pressures. Our research questions are: 1) How are EU ecosystem-based water and marine management policies implemented in the Archipelago Sea? 2) What kinds of synergies and coherence challenges exist between policy sectors of agriculture, aquaculture and offshore wind?

2. Policy coherence and implementing the policy-mixes

The environmental policy of the EU is enforced through directives and regulations, some of which are binding as such, while others need to be implemented into the national legislation of the member states. In a given policy area, such as marine policy, governance rests on a mix of policy instruments and is also influenced by instruments from other policy fields [30]. Enhancing synergies and coherence between policy instruments has been part of discussions on European governance since the early 2000's [31]. EU's environmental policy consists of numerous policy instruments that have integrated various policy goals into their design. The Organization for Economic Cooperation and Development (OECD) has published guidance on policy coherence to achieve sustainable development as part of its better regulation initiatives [32].

Policy coherence refers to relationships between policies, which require coordination, collaboration and cooperation to support the achievement of shared objectives withing and across policies [26,27]. Traditional policy analysis has often focused on the effectiveness of policy implementation, whereas the policy mix approach has studied the consistency and efficiency of a given set of policy instruments within a policy sector or sectors [30]. It is important to note that a sectoral policy can be effective in achieving its own objectives without being coherent with other policy areas and their objectives. Policy coherence has been seen as significant for the successful implementation of policy frameworks, as coherent policymaking can navigate trade-offs and synergies between multiple policy goals and sectors [32–35]. Coherence analysis can combine analysis on policy outputs and integration and the implementation of policy instruments and objectives.

In this paper we study policy coherence, which has been linked to the effective implementation of environmental policies [36,37]. It is a widely debated topic in European policy schemes due to the horizontal and vertical fragmentation of the EU and its member states' institutions and policies. Horizontal coherence refers to synergies and support for the achievement of shared (e.g., environmental) objectives across individual policies [26,36], for example, energy and environmental policies or agricultural and biodiversity policies. Vertical coherence relates to the extent to which the resulting interplay between directives' national and local implementation assists in reaching key environmental objectives.

Alongside the concepts of horizontal and vertical coherence, the concepts policy integration and implementation are relevant for the analytical focus of this paper. Policy integration refers to the process of incorporating overarching objectives, such as sustainable development or environmental objectives into sectoral policies and is linked to policy design [26]. The policy instruments and processes are part of the policy design that aims to achieve policy goals. Policy implementation refers to arrangements and interactions by authorities and other actors for the enforcement of policy instruments [26,28]. Policy evaluation covers all stages of the policy process from policy design to implementation and policy outcomes [26].

To assess and understand the degree of (in)coherence in policy and legal landscapes, we followed CrossGov's policy coherence evaluation framework and methodological guidelines [38]. The project developed a comprehensive framework for evaluating (horizontal/vertical) policy coherence across multiple scales (see the EU-funded CrossGov project. The framework functions as a tool to evaluate at which governance level and where coherence challenges emerge (see Fig. 1). It considers the perspectives of horizontal and vertical coherence. Horizontal Coherence represents coherence between EU policies and between policies from lower level of governance. Vertical Coherence refers to coherence between EU policies and European Green Deal (EGD) objectives, as well as coherence between the examined EU policies and corresponding national implementation policies in selected Member States. Governance Levels are listed from the highest level (International) to the lowest level (Regional), indicating the different levels at which coherence is assessed.

3. Data and methods

3.1. The Archipelago Sea case study

The Archipelago Sea, part of the Baltic Sea, is located in the southernmost part of Finnish territorial waters, and consists of about 40,000 islands [39]. It lies between the Gulf of Bothnia, the Gulf of Finland, and the Åland islands. The sea area is shallow and fragmented, making it particularly vulnerable to nutrient loads of anthropogenic origin, which may lead to cyanobacterial blooms [40–42]. HELCOM has listed the Archipelago Sea and Åland Archipelago as environmental hotspots in the Baltic Sea, making it the only remaining hot spot in Finland [43–46].

The catchment basin consists of nine river basins that run through an agricultural area with clay soil, prone to soil erosion and leaching of nitrogen and phosphorus (see Fig. 2) [47]. Internal nutrient loads pose challenges in nutrient management, as the timeline for improving environmental status is long. Nutrients are stored in the bottom sediments of the sea due to past pollution, which further exacerbates eutrophication in the Archipelago Sea [48]. The nutrient loading trend has been curbed through the multi-layered environmental governance system, with little impact on the environmental status of the Baltic Sea [49]. Regarding eutrophication in the Baltic Sea, the distinction between point source and non-point source pollution is relevant. Point source pollution has declined, while non-point source pollution of phosphorus has not been reduced in any sea area in the last 20 years [48].

Agriculture is the main source of nutrient pollution in the Archipelago Sea. Of the total anthropogenic phosphorus load in the Archipelago Sea area, 87% results from agriculture. Similarly, 68% of the total anthropogenic nitrogen load in the Archipelago Sea results from agriculture [48]. Several other sectors, such as aquaculture, tourism and wastewater treatment, also contribute to the eutrophication. Different

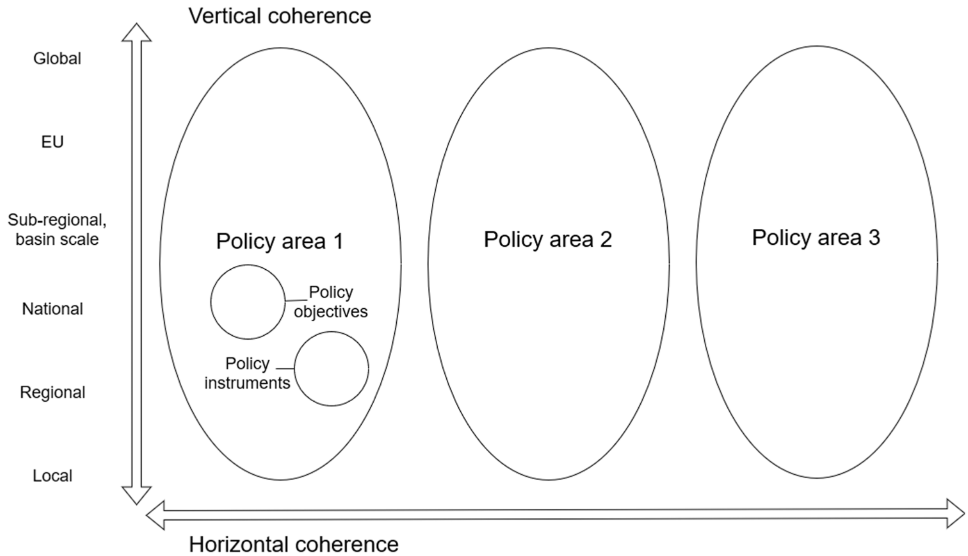

Fig. 1. Horizontal and vertical coherence of sectoral policies.

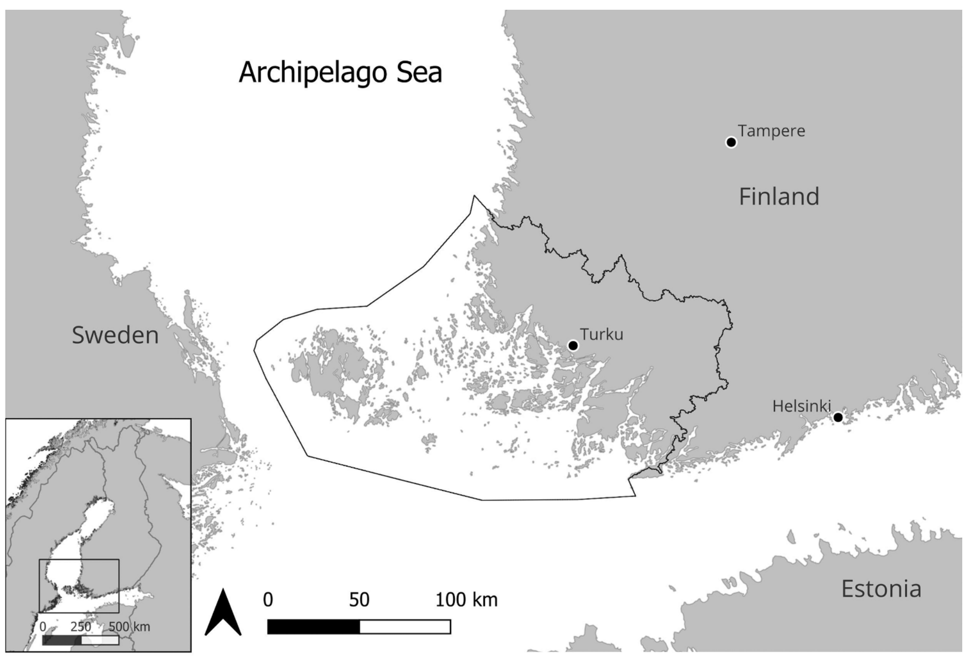

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Fig. 2. Map of Achipelago Sea catchment basin.

sectors may have different priorities, goals and regulations, leading to coherence challenges and making it difficult to achieve overall policy goals. Sectoral policies may have different objectives, steering them in different and potentially incoherent directions. Effective policy implementation may require coherence among different processes, instruments and objectives as well as compliant behaviour of actors.

3.2. Case study data and research methods

We conducted a case study on the Archipelago Sea. Case study research is an empirical research approach, that investigates a phenomenon in depth and within its real-life context [50]. The approach is suitable for data triangulation, through which document material and semi-structured interviews are analysed. As a qualitative research strategy, it is widely applicable investigating complex organisational and managerial processes [51]. Our case study data consist of document material (see Table 1) and 12 online semi-structured interviews (see Table 2) conducted in April 2023.

The document analysis and the semi-structured interviews were conducted as part of the EU Horizon Project CrossGov in 2023–2024. CrossGov studies horizontal and vertical coherence and cross-compliance in the sea basins of the Baltic Sea, North Sea and Mediterranean Sea. The documents selected for this study include cross-sectoral documents, such as River Basin Management Plans (RBMP), Marine Management Plans (MMP), documents related to marine spatial planning (MSP), HELCOM, the Baltic Sea Action Plan (BSAP) and sectoral documents related to specific sectors (see Table 1). These documents were selected based on how they contribute to the coherence analysis targeted at the implementation of the WFD, MSFD, MSPD, CAP and other sectoral policies. We focus our analysis on the implementation of

Table 1
Policy documents included in the Archipelago Sea case study original analysis (titles translated by the authors).

Sub-basin level documents
Baltic Sea Action Plan 2021 [52].
The Baltic Sea joint comprehensive environmental action programme [43].
National level documents
River Basin management plan 2022–2027 for Kokemäenjoki – Archipelago Sea - Botnian Sea River- Basin area, part 1: Information by river basin district [45].
River Basin management plan 2022–2027, Part 2: Methods and principles used in planning [53].
Finnish Marine Strategy part III: Program of measures of the Finnish Marine Strategy 2022–2027 [47].
Maritime spatial plan for Finland 2030 [54].
Finland's national CAP Strategic Plan 2023–2027 [55].
Aquaculture Strategy of Continental Finland [56].
Bioeconomy Strategy of Finland [57].
Environmental Impact Assessment of the Maritime Spatial Plan [58].
The National Aquaculture Location Management Plan [59].
Planning document for water management measures for 2022–2027: Aquaculture [60].
Guidelines for environmental protection in fish farming [61].
Regional level documents
Programme of measures of the River Basin Management Plan 2022–2027 for Southwest Finland and Satakunta [62].
The Archipelago Sea Hot Spot Road Map Project: bottlenecks of agricultural water protection [63].
The Archipelago Sea Hot Spot Road Map Project: Road map of water protection in agriculture [64].

Table 2
Informants of the Archipelago case study in 2023.

Actor	Number of informants	Reference	Additional information
State administrative agency	1	Interview 1	Responsible authority for environmental permits
Centre for Economic Development, Transport and the Environment (ELY Centre)	2	Interviews 2 and 3	Regional environmental administration
Ministry of the Environment	2	Interviews 4 and 5	Ministry responsible for environmental topics in Finland
The Baltic Marine Environment Protection Commission, HELCOM	1	Interview 6	Intergovernmental organisation and a regional sea convention in the Baltic Sea area
The Central Union of Agricultural Producers and Forest Owners (MTK)	2	Interviews 7 and 8	Advocacy group for agriculture and forestry
Finnish Forest Centre	1	Interview 9	State-funded advisory organisation for forest owners
Keep the Archipelago Tidy Association	1	Interview 10	ENGO maintaining the waste management and guest harbours in the archipelago
Archipelago Sea Fish Leader	1	Interview 11	Funding body for economic development of fish industry
Finnish Fish Farmers Association	1	Interview 12	Advocacy group for fish industry
Total	12		

the WFD and MSFD (to answer research question 1) and sectoral policies guiding agriculture, aquaculture and offshore wind power (to answer research question 2).

We conducted semi-structured interviews with 12 actors to obtain up-to-date information and experiences and to verify the completeness of the policies and instruments that will be evaluated. The aim was to gather in-depth knowledge on the coherence challenges and potential synergies among sectoral policies that implement EU environmental directives and regulations at the national or regional level. We interviewed stakeholders from environmental administration, advocacy organisations (sectoral policies) and non-governmental organisations (NGOs) (see Table 2). The recordings were transcribed and imported into Atlas.ti (V.23, www.atlasti.com), which is qualitative content analysis software, where we applied thematic coding.

4. Results – horizontal coherence of sectoral policies in the Archipelago Sea

4.1. River basin management plans and the national marine strategy

To respond to research question 1 and to evaluate the coherence between the WFD and the MSFD, we examined the planning documents for the Archipelago Sea. River Basin Management Plans (RBMP) and their Programmes of Measures (PoM) are drafted under the Water Framework Directive [65], while the Marine Strategy Framework Directive [66], forms the basis for the Marine Management Plan (MMP), Marine Strategy and the program of measures. The PoM of the RBMP defines the actions to be undertaken to achieve the water status objectives by 2027 at the latest [45], and the PoM of the Finnish Marine Strategy also identifies the actions to achieve good marine status by 2027 [48]. The geographical scope of the plans partly overlaps, as both cover coastal waters [46]. The plans are therefore drafted in close collaboration between the authorities.

The policy documents share common goals of reducing eutrophication and pollutants. For surface waters, the RBMP has focused on reducing nutrient load as the major cause of the poor status of surface waters in the region [62]. The PoM of the Marine Strategy sets environmental objectives to reduce nutrient pollution and eutrophication and to improve the status of the sea [48]. It also sets out measures to achieve this objective, although some of the activities, e.g. stormwater management run under the RBMP [46]. It has been stated in the RBMP PoM that the reduction of nutrient loads from land-based sources can be achieved by implementing measures under both plans, although achieving a good status of coastal waters and the marine environment by 2027 may be hindered by natural delays [46]. Due to internal nutrient stocks in the sea, improvements are slow, and the effects of measures are visible only after a time lag [48].

Several measures target eutrophication in the Baltic Sea, such as setting nutrient loading boundaries in environmental permits, introducing buffer zones and nature-based solutions for reducing agricultural run-off, improving biodiversity or by reducing risks. Both the RBMP and MMP have introduced multi-sectoral measures to reduce eutrophication, including legislative actions, financial guidance, increased information and research [48,62]. The agricultural measures under the RBMP and MMP focus on promoting and targeting the implementation of CAP measures. Also, measures have been introduced to address marine litter and noise pollution in the Baltic Sea. Different administrative sectors contribute to implementing these measures within their budgets and frameworks. The RBMP highlights that implementation has been impacted by the voluntary nature of the measures and their dependence on cross-sectoral cooperation [48].

4.2. Agricultural policies for water protection

The Common Agricultural Policy (CAP) is the main instrument for promoting agriculture and its financing in the EU. Under the CAP reform, water protection measures with a significant impact on water protection in agriculture, are included in the eco-scheme and environmental payment system, which is the main financial mechanism for decreasing the nutrient load of agriculture. The subsidies are nationally described in Finland's CAP plan for 2023–2027, which entered into force in January 2023 [55,67]. The environmental payment system is voluntary for farmers, 86% of whom are committed to the system in Finland [62]. In the RBMP, the suggested agricultural measures are firmly related to the environmental payment system, and one of the objectives in the RBMP is targeting the CAP project subsidies on water protection measures [62]. Also, the Nitrates Directive [68] regulates water protection in agriculture by preventing nitrates from agricultural sources from polluting surface waters and by promoting the use of good agricultural practices. Nationally, it is implemented by the Nitrates Regulation [69].

The Baltic Sea is one of the most heavily polluted seas in the world and governed by the international organization, HELCOM, with contracting parties of Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden and the European Community [70]. HELCOM monitoring programmes have contributed to significant data availability, which have been used to e.g. modelling ecosystem dynamics and made the Baltic Sea also one of the most studied marine systems in the world [70]. The HELCOM Baltic Sea Action Plan (BSAP) recognises that agriculture has significant nutrient reduction potential, as the diffuse sources have not achieved a significant reduction during a 20-year observation and that the diffuse nutrient emissions contribute to 35% of riverine input [52]. To further analyse the nutrient reduction potential and to provide pathways for nutrient emission reduction, the Archipelago Sea Hot Spot Road Map project produced a separate document on the bottlenecks in agricultural water protection in the area [63]. According to the bottleneck report, the main reason for the incoherence between water protection and agriculture is the low profitability of agriculture and the low level of subsidies for conservation measures [63]. As identified in the bottleneck project, the complexity of the subsidy system has slowed down the implementation of the measures; funding for agricultural water protection measures originates from several sources, and CAP-based targeting has been perceived as complex. It is also stated in the RBMP that the challenge remains financing the measures and targeting them more precisely to the most problematic areas [45]. According to the hotspot report, water protection measures have not been sufficiently targeted in areas where they bring the greatest benefits [63]. One of the interviewees stated:

"Point source pollution can be targeted. Because it requires an environmental license, you have to do something there, and then the water management measures are mostly voluntary, which, for example, target the agricultural sector." (Interview 2).

Based on the bottlenecks described above, the Archipelago Sea Program has developed a roadmap describing the most effective measures for agricultural water protection in the region [63]. To overcome these bottlenecks, the program emphasises soft and voluntary policy instruments. The lack of information among farmers in the Archipelago catchment area has been recognized as a reason for the low level of implementation of agricultural water protection measures [63]. As the measures are voluntary and operators are responsible for implementing them, it is essential to provide information. One of the measures introduced in the roadmap aims to collect existing water protection information in the catchment area. The roadmap states that existing water protection related knowledge must be gathered and made available to different actors comprehensively.

In addition to the agricultural subsidy system, water protection in agriculture is promoted through project activities, which play a significant role to improve water quality [64]. For example, the Ministry of the Environment, Finland, funds a programme to promote nutrient recycling and a water protection programme, under which gypsum treatment of fields has been carried out in the catchment area of the Archipelago Sea [71–73].

4.3. Aquaculture

Aquaculture is the main source of point pollution in the Archipelago Sea [74,75]. A total of 55 fish farms operated in the Archipelago Sea in 2020 [62]. The production is concentrated in the Archipelago Sea, and the nutrient load is locally significant in certain water bodies [62]. The nutrient load from fish farming has been reduced in past decades because of efficient measures taken as part of environmental licensing and monitoring actions. The main coherence challenge, which the interviewees pointed out, was between the environmental payment scheme for agriculture and the environmental licensing of the aquaculture sector. This was mentioned by several of the stakeholders interviewed. One of the interviewees commented as follows:

"In the Archipelago Sea basin area, fish farmers are for some reason upset about agriculture … And then they wonder why agriculture can pollute, and they must do this and this much. Therefore, this type of contradiction exists." (Interview 8).

Aquaculture requires an environmental license under the Environmental Protection Act [76] and a water permit under the Water Act [77]. The competent licensing authority is the Regional State Administrative Agency, and the Regional Centres for Economic Development, Transport and the Environment (ELY Centres) are responsible for monitoring. The authorities must consider the water status objectives of the WFD, the RBMP and the MMP when issuing a permit. The overall environmental objective of achieving a good status of all waters is largely hindering the development of coastal aquaculture, and the RBMP has stated that the overall load should not be increased as the ecological status of coastal waters is classified largely less than good (ELY Centre 2022). In addition, the MMP introduced a general nitrogen and phosphorus load cap that should not be exceeded [47]. The plan also includes an explicit target to ensure that the nutrient load from aquaculture does not threaten the achievement of a good marine status or the status already achieved [47]. Consequently, the general obligations under the Environmental Protection Act, such as the requirement for using the best available techniques, also apply to aquaculture, and the Land Use and Building Act governs the placement and construction of installations [61]. Measures to protect and improve the efficiency of fish farming are decided on a case-by-case basis during the environmental licensing procedure (Interview 1).

The aquaculture strategy aims at sustainable growth for the sector and to increase aquaculture production to 25,000 tons by 2030 [56]. Although the goal is to grow the aquaculture industry, the plan refers to the RBMP and MMP objectives, which should not be compromised when implementing the strategy. As the plan identifies, the ecological sustainability of aquaculture production is a prerequisite for the development of the sector, meaning that ecological sustainability is the starting point for development [56]. In addition, Finland's bioeconomy strategy also proposes multiplying the added value of the aquatic biomass and refers to achieving and maintaining the good status of waters [57]. As stated in the Bioeconomy Strategy, cooperation between the private and public sectors is essential for the introduction of technologies that support water protection [57]. The development and adoption of new aquaculture technology is one of the most essential tools for reducing the nutrient load from aquaculture. The construction of water recirculation plants is mentioned as a measure in the RBMP [53]. This measure is also linked to the development of operational conditions for circulatory aquaculture facilities.

One of the measures identified in the RBPM, the MMP and the aquaculture strategy is to update the National Aquaculture Location Management Plan, which was drafted in 2014 and is outdated [56,59,60]. The development of this guideline is carried out by the Ministry of the Environment and the Ministry of Agriculture and Forestry. The document is a guidance tool, which aims to reconcile the interests of environmental use and water protection by identifying suitable areas for aquaculture. It can be used to identify areas where aquaculture production can be sustainably increased without compromising the objectives of the RBMP and the MMP and with a minimum impact on other uses of the water body [45]. In the plan, it is stated that because of the condition of the Archipelago Sea, aquaculture cannot be further increased in the area, but existing production could be concentrated in larger farms [59]. The location plan cannot oblige existing operators to move their activities to a less polluting location, yet it can guide the authorities and operators in the sector and can also be considered in land-use planning [61,62]. Consequently, an updated location management plan for aquaculture and its efficient implementation may contribute to the coherence of the different objectives.

4.4. *Offshore wind power*

The policy objective of increasing the production of offshore wind power is connected to the EU's energy and climate targets for 2030 and 2050. As part of the EU's Green Deal, the EU's Offshore Renewable Energy Strategy sets ambitious targets for increasing offshore wind capacity from the current 12 GW to at least 60 GW by 2030 and 300 GW by 2050 [20]. This requires multiplying the capacity for offshore renewable energy almost 30 times by 2050 [20]. National strategies contribute to EU targets for increasing offshore wind energy. The National Climate and Energy Strategy of Finland includes a section on offshore wind, aiming at several offshore wind farms in operation by 2035 [78].

The Finnish coastline in the Baltic Sea region is ideal for offshore wind energy production due to the coast's shallow water depth, short distance from the coast, and the proximity of electricity connection (Meriskenaariot.info). Despite this potential, the lack of economic feasibility has hindered the construction of more offshore wind farms [79]. By 2030, it is estimated that the capacity of offshore wind power in the Baltic Sea will increase by 130–390% and the area of offshore wind farms by 350% [47]. The growth of offshore wind power production has been identified in the MMP as a pressure on the marine environment [47]. As offshore wind energy production increases, it is likely that more areas will be affected by changes in hydrographic conditions, e.g. water currents, wave formation, salinity and temperature. Increasing offshore wind energy construction is a major source of underwater noise. The MMP includes a measure to reduce underwater noise from offshore wind construction [47]. Impacts on marine biophysical communities and aquatic habitats (e.g., fish spawning grounds) and birdlife may arise particularly during the construction phase. The Maritime Spatial Plan, which aims at reducing conflict and creating synergies between activities also identifies the need to coordinate offshore wind farms with the migratory pathways of birds [54].

Planning and implementing offshore wind power farms requires several permits, such as a water permit, an environmental permit, a building permit, an air traffic control permit and a permit to explore and survey the seabed in territorial waters. An environmental impact assessment must be carried out and, under certain circumstances, the Natura 2000 assessment. Several planning documents provide guidance for the identification of potential areas for offshore wind farms. Projects are planned in areas identified in the Maritime Spatial Plan (MSP) as potential areas for offshore wind power [54]. When identifying those areas, shipping lanes, sea depth, Natura 2000 sites and other ecological values, landscape values and other maritime livelihoods, among other values, are considered [58]. A total of 15 offshore areas have been identified in the MSP; most of these areas are in the Northern Bothnian Sea, Quark and Bothnian Bay and two in the Archipelago Sea [54].

Conflicts between locating offshore wind farms and trawling areas may arise [54]. As identified in the Offshore Renewable Energy Strategy, maritime spatial planning is an essential and well-established tool for anticipating change and preventing and mitigating conflicts between sectors while also creating synergies between them [20]. Several sectors have both conflicts and synergies with offshore wind power; for instance, it may affect fishing negatively by impacting the routes and spawning areas of migratory fish. One of the interviewees commented:

"Offshore wind areas are going to be mainly no-go areas for fishers. Thus, even at their best, they are through passes so that the trawler can pass, except the actual fishing." (Interview 5).

Some sectors can explicitly benefit from offshore wind power production. For example, aquaculture and offshore wind power can potentially benefit from each other; they may utilise the same maintenance connections if they are placed near each other and offshore wind farm structures can be used as artificial reefs Maritime logistics can benefit offshore wind power because it allows access to offshore wind farms [20]. It also causes challenges to other maritime uses in the area. For example, the MSP identifies that defence needs may limit the use of certain areas for offshore wind energy production, as due to the placement of radar installations, it is impossible to reconcile the Defence Forces' needs with offshore wind power [54]. Although areas suitable for offshore wind energy production are identified in the Marine Spatial Plan as "areas with potential for offshore wind energy", coordination of these sectors is likely to be challenging in the Archipelago Sea area.

5. Discussion

We studied the coherence of the ecosystem-based management policies in the Archipelago Sea. As a hotspot area, our focus was on the Archipelago Sea, to highlight the challenges and conflicting policy objectives that might hinder positive development in the region. We scrutinized the horizontal and vertical coherence of three sectors: agriculture, aquaculture and offshore wind energy.

The main coherence challenge lies between the environmental payment scheme of agriculture and the environmental licensing of the aquaculture sector. Many of the current agricultural practices cause nutrient runoff, which decreases water quality. The challenge lies in the financing and subsidies of measures and targeting them to the most problematic areas. Our study recognised several reasons for this. First, the voluntary support scheme consisting of agri-environmental support and eco-schemes continues to be inefficient, expensive and provides low incentives for innovation. It does not allow the targeting of agri-environmental policies to the most vulnerable river basin areas or apply nutrient mitigation measures where they would be most efficient. Second, the management of nutrient loading and the sharing of costs and benefits continue to be inefficient. Finland's agri-environmental scheme has typically overcompensated for conservation costs, providing implicit income support to farmers. This has resulted in high participation rates in the scheme compared to other EU member states, although the net benefits of participation are close to zero or even negative, and water protection measures in agricultural areas have been insufficient [80,81]. The subsidies that the farm receives are mostly targeted for improved agricultural production and only to some extent allocated based on environmental performance, despite the various environmental measures funded under CAP scheme. In Finland, the project-based approaches, such as Gipsum project have been more efficient in reaching reduction in the nutrient leaching [73]. Third, Finland's scheme pays for management practices instead of paying for performance in reducing nutrient loading, which is costly, complicated and backward-looking [82].

The fish farming sector's impact on water quality and biodiversity is highly dependent on the location of the operation and the technology used. Investment in the sector is encouraged by EU and national water management objectives, which aim to improve the status of coastal and marine waters and subsequently decrease the cumulative nutrient load from different sectors, including aquaculture. There are incoherences in the policy goals that have led to a situation where it is somewhat unclear to the businesses, governmental authorities, NGOs and other societal actors which direction the sector should take. The fish farming sector has been source of environmental conflict for decades in the Archipelago Sea region [75,83] and although part of the nutrient load challenges has been resolved, increase in aquaculture operations would be against the environmental status goals introduced in HELCOM action plan and the WFD and MSFD [52]. Consequently, incoherent policy goals, a lack of effective measures for the management of cumulative nutrient load, tightening permit requirements and a lack of clear strategy for renewing aquaculture operators hinder the development of the entire aquaculture sector [84]. The incoherent policy goals do not offer clear pathways for the future development of the sector [85].

The key concern related to offshore wind power is the location of these operations. Offshore wind power is expected to multiply in the Baltic Sea basin, making the coordination of activities from different sectors challenging in the Archipelago Sea area. As demand for marine space increases, significant impacts on marine biodiversity, fish spawning and migration routes and challenges to ship traffic need to be mitigated. Conflicts between multiple uses of the sea basin are likely to arise. The MSP addresses the horizontal coherence of policy sectors and consolidates conflicts between the sectors and different land uses. Improvements in the implementation of the MSFD by strengthening the legal status in planning and permitting specific activities could translate general marine environmental protection targets into more concrete legislation and policies to guide the development of the offshore wind sector [86]. Spatial plans specifically targeting offshore wind power could be developed, and they should have a clear link to water permitting.

6. Conclusions

We studied policy coherence among the policy sectors of agricultural, aquaculture and offshore wind sectors in the Archipelago Sea. We recognized that marine policy is multilevel, complex and fragmented. Horizontal policy coherence challenges exist between the sectors, requiring policy coordination aimed at the managing the cumulative nutrient load to the Baltic Sea through improved coherence, technological development and nature-based solutions (NBS) [85,86]. Suggested solutions include reducing nutrient leaching from river basins, liming, and seaweed farming, which can absorb nutrients such as phosphorus and nitrogen derived from agriculture [87]. Also, vertical coherence challenges exist, necessitating further integration of environmental topics into the core of economic policies. Evidence from the Archipelago Sea case study highlights the opportunities and synergies offered by implementing international and EU legal frameworks to steer sectoral decisions that may strengthen marine resilience and biodiversity.

CRediT authorship contribution statement

Elina Heikkilä: Writing – original draft, Data curation. **Antti Belinskij:** Writing – review & editing, Writing – original draft, Supervision. **Eerika Albrecht:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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