aquacross

Bottom-up policy review of AQUACROSS case studies

Deliverable 2.3

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Authors

Lina Roeschel, Helene Hoffmann, Manuel Lago, Josselin Rouillard (Ecologic Institute)

Asya Marhubi (IMDEA)

Verena Mattheiß (ACTeon)

Kate Reilly (IUCN)

With contributions by:

Gerjan Piet (Wageningen University & Research); Alejandro Iglesias-Campos (IOC-UNESCO); Andrea Funk (BOKU); Tim O'Higgins (University College Cork); Ana I. Lillebo (University of Aveiro); Romina Martin (SRC); Nele Schuwirth (EAWAG); Hugh McDonald (Ecologic Institute)

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List of Abbreviations

BD2020	EU Biodiversity Strategy to 2020
BHD	Birds and Habitats Directive
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CF	Cohesion Fund
CFP	Common Fisheries Policy
CIS	Common Implementation Strategy
DPSIR	Drivers- Pressures- State-Impact-Response
EAFRD	European Agricultural Fund for Rural Development
EBM	Ecosystem-based Management
EC	European Commission
EEA	European Environment Agency
EMFF	European Maritime and Fisheries Fund
ERDF	European Regional Development Fund
GES	Good Environmental Status
IAS	Invasive alien species
IBRM	Intercontinental Biosphere Reserve of the Mediterranean
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
RBMPs	River Basin Management Plans
RDPs	Rural Development Programmes
WFD	Water Framework Directive

About AQUACROSS

Knowledge, Assessment, and Management for AQUAtic Biodiversity and Ecosystem Services aCROSS EU policies (AQUACROSS) aims to support EU efforts to protect aquatic biodiversity and ensure the provision of aquatic ecosystem services. Funded by Europe's Horizon 2020 research programme, AQUACROSS seeks to advance knowledge and application of ecosystem-based management (EBM) for aquatic ecosystems to support the timely achievement of the EU 2020 Biodiversity Strategy targets.

Aquatic ecosystems are rich in biodiversity and home to a diverse array of species and habitats, providing numerous economic and societal benefits to Europe. Many of these valuable ecosystems are at risk of being irreversibly damaged by human activities and pressures, including pollution, contamination, invasive species, overfishing and climate change. These pressures threaten the sustainability of these ecosystems, their provision of ecosystem services and ultimately human well-being.

AQUACROSS responds to pressing societal and economic needs, tackling policy challenges from an integrated perspective and adding value to the use of available knowledge. Through advancing science and knowledge; connecting science, policy and business; and supporting the achievement of EU and international biodiversity targets, AQUACROSS aims to improve ecosystem-based management of aquatic ecosystems across Europe.

The project consortium is made up of sixteen partners from across Europe and led by Ecologic Institute in Berlin, Germany.

Contact	aquacross@ecologic.eu
Coordinator	Dr. Manuel Lago, Ecologic Institute
Duration	1 June 2015 to 30 November 2018
Website	http://aquacross.eu/
Twitter	@AquaBiodiv
LinkedIn	www.linkedin.com/groups/AQUACROSS-8355424/about
ResearchGate	www.researchgate.net/profile/Aquacross_Project2

1 Introduction

The EU Biodiversity Strategy, adopted in 2011, aims to halt biodiversity and ecosystem services loss across Europe by 2020. This Strategy sets six targets (see Table 1), including specific objectives for the protection of aquatic biodiversity. These include the sustainable use of fisheries resources, achieving good environmental status (GES) of EU seas by 2020, and successfully combatting invasive alien species (IASs). Additionally, it aims to complete the establishment of Natura 2000 protected areas, Europe's network of natural and semi-natural habitats protecting an array of valuable and threatened species and habitats within the EU.

The Strategy is implemented by a plethora of environmental directives, regulations and policies on the European level, which create a complex yet comprehensive policy network for biodiversity conservation (Rouillard et al. 2017 (D2.1), Boyes and Elliot, 2014). Central to implementation are the Birds and Habitats Directive, and, for aquatic species, the Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD), amongst other environmental regulations that see to the achievement of its objectives.

However, the 2015 Mid-Term Review of the EU Biodiversity Strategy to 2020 concluded that biodiversity protection is deficient and that, at current trends, the EU will fail to achieve its goal of halting the negative effects of anthropogenic activities on ecosystems by 2020 (EC, 2015). Despite the environmental policy framework in place to safeguard aquatic biodiversity, it identified that species loss has continued and, in some cases, has worsened since 2010. These negative trends are especially apparent for aquatic biodiversity in the EU's freshwater, coastal and marine realms, which have suffered as a result of economic activities over the last decades (EEA, 2012 and 2015a,b), as they are difficult to monitor and because high dependencies across the aquatic system requires a holistic management approach (EEA, 2015b).

Rouillard et al. (2017) (D2.1) found that at the EU-level sectoral policies support drivers of biodiversity loss, reducing the potential effectiveness of the EU's environmental policies. In this paper, we investigate whether the same is occurring at the local level. To do so, we examine conflicts and gaps between local environmental and sectoral policies in eight AQUACROSS case studies. We find that, similarly to the EU level, at the local level, as aquatic biodiversity declines across Europe, sectoral activities that drive biodiversity loss receive strong policy support. While local level policy frameworks include environmental targets, they simultaneously drive biodiversity loss by supporting economic activity through funding mechanisms and regulatory instruments. This conflicting policy mix results in sectoral ambitions outweighing environmental ones, thus contributing to the ongoing decline of aquatic biodiversity in Europe.

1.1 Policy orientation in AQUACROSS

Understanding and framing existing and proposed policy processes is required to ensure the relevance of the AQUACROSS findings to inform and provide concrete advice on the future implementation process of biodiversity protection targets for aquatic ecosystems. The "Policy Orientation" Work Package within the AQUACROSS project identifies and explores how specific features of the existing nature, water, and marine policies can be coordinated in an integrated framework that specifically addresses the EU 2020 Biodiversity Strategy targets. Past deliverables have included the review of accompanying policy documents, the efforts of the EU Common Implementation Strategy (CIS) of the WFD and the MSFD, identifying operational objectives, concepts, and terminology, and experiences with implementing policies, to inform all other parts of AQUACROSS (Rouillard et al. 2017, D2.1). This exercise identified and highlighted the synergies, barriers and opportunities between water-, marine- and nature-relevant policies for more effective implementation of environmental protection policies across aquatic ecosystems in Europe, resulting in the streamlining of approaches, leading to the implementation of integrated ecosystem-based management (EBM) approaches for aquatic ecosystems. In this report, local transposition of EU policies is examined to identify challenges, gaps and opportunities for reaching the targets of the Biodiversity Strategy on the local scale.

The overall aim of WP2 "Policy Orientation" is to provide policy direction for all research within AQUACROSS. Specific objectives (from the Description of Action) include:

- Determine the extent of existing and planned EU policies and laws to achieve and/or hinder EU and international biodiversity targets.
- Determine coherence and/or incoherence of current environmental protection policies affecting the management of aquatic ecosystems.
- Establish a common language for nature, freshwater, coastal and marine environmental protection policies to collectively achieve the EU 2020 Biodiversity Strategy targets.
- Identify end-user needs in terms of data and information systems, as well as lessons learned with fulfilling policy requirements for data.
- Synthesise the insights gained from AQUACROSS for practitioners and policy-making.

1.2 Objectives of the report

The main objective of this report is to support AQUACROSS case studies in the identification of relevant policy-led actions at the local level for the management of aquatic biodiversity. Specifically, it provides guidance to perform an integrative policy characterisation of the case studies in AQUACROSS according to the project's objectives.

The underlying aim of the analysis is to discuss whether European policy implemented on the local level have a synergistic or conflicting mix of instruments to address the main threats harming aquatic biodiversity, and whether any gaps in policy instruments and their

implementation exist, especially when EU laws are transposed at the local level. By focusing on the transposition of the EU policy framework within the case studies, we examine the influence of European policies on aquatic biodiversity and its protection at the local level.

This analysis is one of the components for understanding the complex social-ecological system in the case studies. The policy analysis will be also useful for the collection of relevant policy data at the case study level, specifically for the:

- Identification of relevant drivers and the definition of relevant policy indicators useful for their description according to existing policy evaluation frameworks.
- Identification of relevant pressures to aquatic biodiversity and definition of relevant policy indicators according to existing policy evaluation frameworks.
- Identification and definition of relevant environmental status indicators at the case study level according to existing policy evaluation frameworks.
- Identification of appropriate policy scales for the analysis.
- Identification and preliminary EBM analysis of measures/policies relevant for the management of aquatic biodiversity at the local level.

1.3 Content and structure of the report

In order to achieve the objectives presented in the previous section, this deliverable follows three types of analysis, further described in Section 2.4 Methodology for analysis. Firstly, key threats to aquatic biodiversity in the AQUACROSS case studies are described in terms of their effects on the state and status of the case studies, as well as future trends. Secondly, drivers of these threats are analysed. Thirdly, the key environmental and sectoral policies protecting and hindering aquatic biodiversity in freshwater, coastal and marine case studies are reviewed to examine the degree to which they can work synergistically or antagonistically for the implementation of EBM[1]. EBM is the core concept of AQUACROSS. It points towards the use of specific measures focused on the enhancement and restoration of ecosystem processes and functions. EBM represents a functional management approach for enhancing the protection of biodiversity, and thus is a useful concept to assess how existing environmental policies work together to protect biodiversity.

1 Based upon a thorough revision of the extensive available literature around EBM, the AQUACROSS concept (Del. 3.1) and Assessment Framework (Del. 3.2) define EBM "as any management or policy options intended to restore, enhance and/or protect the resilience of the ecosystem" (Gomez et al. 2017 and 2016). Put simply, the AQUACROSS definition of EBM focuses on the concept of ecosystem health. This definition also includes any course of action intended to improve the ability of ecosystems to remain within critical thresholds, to respond to change and/or to transform to find a new equilibrium or development path. In this context, EBM sets the foundations for the development of effective and widely applicable management concepts and practices for aquatic ecosystems.

2 Setting the Scene for the Analysis

2.1 Study area

Eight case studies were selected on the basis of showcasing specific elements of the objectives of the EU Biodiversity Strategy to 2020 (Table 1) relevant for the management of aquatic ecosystems and to help understand the most relevant changes surrounding the protection of aquatic biodiversity in Europe. For example, the management of Natura 2000 sites (target 1) is central to the Aveiro case study in Portugal, while sustainable fishing (target 4) is central to the marine case studies of Azores and the North Sea, where overfishing is one of multiple conflicting activities within the ecosystem. In addition to supporting the attainment of the different aspects of the EU Biodiversity Strategy to 2020, the selected case studies cover the diversity of the European aquatic realms, focusing on freshwater habitats (Danube, Lough Erne, Swiss Plateau), coastal (Intercontinental Biosphere Reserve of the Mediterranean, Ria de Aveiro) and marine ecosystems (North Sea, Azores) (Table 2).

In addition, the case studies allow for a comparison between European ecosystems under the jurisdiction of EU Member States, including an example from the EU's outmost regions (Azores), as well as others outside the EU (Switzerland, Morocco). For transnational case studies, a single country was selected to focus the policy review in order to constrain the size of the analysis. The selection was based on the severity of pressures to aquatic biodiversity (i.e., Netherlands for the North Sea and Austria for the River Danube).

Table 1: Links between AQUACROSS case studies and the EU Biodiversity Strategy targets

EU BD2020 Targets	AQUACROSS Case Studies							
	North Sea	IBRM	Danube River	Lough Erne	Ria de Aveiro	Sweden	Swiss Plateau	Azores
Target 1: Fully implement the Birds and Habitats Directives	X	X	X	X	X		X	X
Target 2: Maintain and restore ecosystems and their services	X	X	X	X	X	X	X	X
Target 3: Achieve more sustainable agriculture and forestry		X	X	X	X	X	X	
Target 4: Ensure the sustainable use of fisheries resources	X	X						X
Target 5: Combat invasive alien species				X				
Target 6: Help avert global biodiversity loss.		X						X

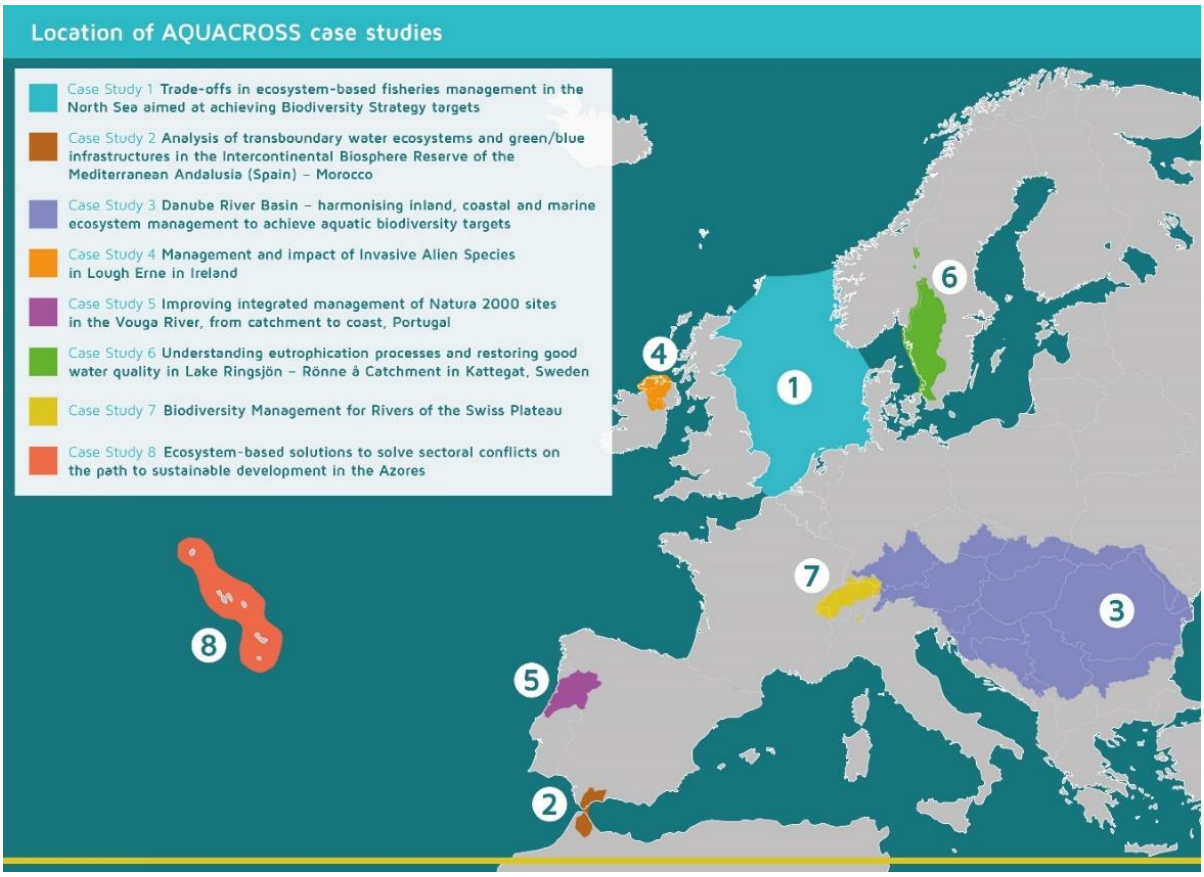

Figure 1: The eight AQUACROSS case studies

Table 2: Short description of the eight AQUACROSS case studies and their realm

Case Study	Description	Freshwater	Coastal	Marine
1	In the **North Sea**, the extraction of species in particular has led to multiple impacts, including species mortality and physical damage of habitats through bottom trawling. Development of offshore wind energy has led to physical changes, i.e. to the seabed and underwater noise.			
2	The **Intercontinental Biosphere Reserve of the Mediterranean** (IBRM) is shared between Spain and Morocco. While almost 70% of the Spanish section of the IBRM is protected, only 30% of the Moroccan section has received similar legal protection. Among many drivers, the growing tourism industry is significant to the degradation of coastal habitats.			
3	The **Danube River** case study is centred around hydro-morphological pressures on catchment and regional scale, with a focus on longitudinal and lateral connectivity. Longitudinal river connectivity is in particular considered in relation to hydropower plants.			
4	The **Lough Erne** case study in Northern Ireland is focused on invasive alien species, primarily introduced through recreational boating and fishing, which allow organisms to be transferred between waterbodies on equipment. The presence of invasive species is changing the lake ecology, including triggering a shift from turbid to clear water, a decrease in algal biomass, and outcompeting several native species. Agricultural nutrient pollution is also significant.			
5	The **Ria de Aveiro** river, estuary, and coast is threatened by alterations to hydromorphology. Dredging to enable maritime transport and the construction of a floodbank have the potential to drive biodiversity loss, through decrease in seagrass beds and decrease in nursery function and modification of nutrient cycling. This case study considers how to minimise these unintended impacts to the Natura 2000 protected area.			
6	**Rönne å catchment area** is a river and lake watershed located in Southern Sweden. The primary land use in the region is agriculture. Local population growth has also put pressure on the environment with increasing municipal sewage treatment needs and the conversion of rural dwellings where sewage treatment is difficult to regulate			
7	The **Swiss Plateau** ecosystem has been affected by hydroenergy activities, flood protection and land gaining activities for settlements and agriculture, which have led to major morphological river modifications that in turn have lead to biodiversity loss. More than 20% of endangered or extinct species in Switzerland are water-bound, and another-fifth to shores and wetlands.			
8	The **Faial-Pico Channel** is a 240km² biodiversity rich Marine Protected Area in the Azores, an Outermost Region of the EU. The Channel is considered one of the best examples of Macaronesian coastal ecosystems in the Azores. Commercial and artisanal fisheries's extraction of species is recognised as the most significant pressure, though emerging pressures from tourism may pose future challenges.			

2.2 Transposition of EU law and application at the local level

This report presents an integrated assessment of how the EU policy framework influences policy instruments established at the local level. The analysis is mindful of the EU law transposition process flow. There is no one-size-fits-all approach to transposing EU law into Members State law; each EU country applies implementation rules according to their own legal frameworks. However, and to avoid duplication, it is important for our analysis to get an understanding of the types of policy instruments that are driven by EU law, how they connect with each other and how they differ. In this context (and using the UK as an example in brackets), the basic flow follows this sequence: First, International treaties and conventions drive the development of EU law, subsequently, EU Directives and Regulations are created and then must be transposed into Member State law (e.g., EU Water Framework Directive drives the formulation of the UK combined and devolved Water-related Acts), thirdly, Member States implement the laws through their own regulations (e.g., UK Water Acts drive the development of water-related controlled activities regulations), and finally, sub-national and regional implementation is established through further regulations, management, monitoring and reporting (e.g., UK combined and devolved Regulations: water related orders and guidance for England and Wales).

Our analysis applies existing policy-relevant definitions of Drivers and Pressures (Rouillard et al., 2017 (D2.1), Elliott et al., 2017; Patrício et al., 2016; Anzaldúa et al., 2017; Gari et al., 2015; Hering et al., 2015; Haines-Young and Potschin, 2013; Maes et al., 2013; CIS, 2011; Fisher et al., 2009). A driver is a human activity, in particular production and consumption processes, that may produce an environmental effect (i.e., a pressure) on the ecosystem. Production or consumption processes are structured according to economic sectors (e.g., agriculture, fisheries, renewable energy, tourism). A pressure is understood as a mechanism through which a driver has an effect on the environment. Pressures can be of a physical, chemical or biological nature, and include for example the extraction of water or aquatic species, emissions of nutrients, the introduction of invasive alien species, and alterations to morphological conditions (for further information see Rouillard et al., 2017 (D2.1)).

2.3 Identifying drivers and pressures of biodiversity loss at the local level

AQUACROSS researchers worked with stakeholder groups in each of the eight case studies to identify relevant pressures (or 'threats') to aquatic biodiversity in the respective local area and the drivers of those pressures for which there are local concerns (Table 3). Here, the AQUACROSS case studies also drew on the AQUACROSS linkage framework (Costea et al. 2018

(D4.2) and Teixeira et al. 2018 (D5.2)), which identified the presence and links between human activities (drivers), pressures, habitats, ecosystem functioning, and ecosystem services. Identification of key drivers and pressures differed in the case studies, and included qualitative and quantitative approaches, local stakeholder collaboration, literature review and others (see McDonald et al. 2018 (D9.2) for more information on each case study). Five pressures across eight case studies were reviewed: nutrient pollution, extraction of species, abstraction of water, invasive alien species and alterations to morphological conditions of aquatic habitats. Four drivers, prioritised by local stakeholders, were prevalent in the eight case studies and thus selected for further analysis: agriculture, fisheries, renewable energy and tourism.

Table 3: Main drivers and pressures to the eight AQUACROSS case studies selected for local policy analysis

Case Study	Driver				Pressure				
	Agriculture	Fisheries	Energy	Tourism	Nutrient pollution	Extraction of Species	Water Abstraction	Invasive Species	Alteration to Morphology
1 North Sea		X	X			X			X
2 IBRM	X			X			X		X
3 Danube River	X		X	X	X		X		X
4 Lough Erne	X			X	X			X	
5 Aveiro River				X					X
6 Sweden	X				X				
7 Swiss Plateau	X		X		X				X
8 Faial-Pico Channel		X		X		X			

2.4 Methodology for analysis

We undertook an in-depth review of relevant local policies for each case study and the linked effect on drivers of pressures to the local aquatic biodiversity, highlighting gaps and conflicts in each policy framework. We focused on the selected priority threat, identified as described above. For each local policy, we identified how it influences human activities and potential uses

of aquatic environments that result in pressures. This includes, for example, how local policy instruments influence the type of economic activity (e.g., subsidies for organic farming) or practices (e.g., farm best management practices) (Figure 2).

To conduct this review, we first described the drivers and pressures related to the priority threat in the case study and the state and status of the ecosystem, including anticipated future trends. This description was intended to give context to the policy analysis and other aspects of the case study research (e.g., developing baseline scenarios).

We then selected a set of policy instruments at European, national, regional and local levels that act on the selected threat at local level, either positively or negatively. Policy instruments included regulations; economic instruments (tariffs, taxes, voluntary agreements, etc.); information, awareness raising and public engagement activities; and monitoring and research. The policy instruments were selected through consultations with case study partners of AQUACROSS, focusing on those instruments that increase the main driver or pressure associated with the selected threat (key sectoral policy) or that reduce the driver/pressure (key environmental policy). Examples of particularly good or challenging implementation of policy instruments were also analysed to provide lessons learnt for tackling similar threats elsewhere.

For each of the selected individual policies, we identified their main aims, targets, current difference between state and target, spatial scale, stakeholder groups and associated management measures. We identified which component of the DPSIR framework they act upon. We then analysed combinations of policies to determine how individual policy instruments acted both synergistically and antagonistically to tackle the threat, as well as to identify gaps in the policy framework.

Figure 2: Integrative policy analysis following the Drivers-Pressures-State-Impact-Response (DPSIR) framework

3 Local Policy Frameworks across case studies

While we focused our analysis limited priority threats to aquatic biodiversity, this often involved assessing a complex set of regulations. For example, alterations to morphology is a threat shared among several case studies, both in freshwater habitats as well as in the coastal and marine realm, but this is associated with different sectors and policies in the different cases studies: for example, alteration to river beds and to the connectivity of freshwater ecosystems is caused by navigation along a river and flood protection measures along the river banks, while hydropower constructions play a major role in disrupting the natural habitat of species. In the coastal realm, tourism and linked seaside construction negatively impacts biodiversity along the Andalusian and Moroccan coastline. In the Dutch part of the North Sea, the construction of off-shore windfarms has caused alterations to the seabed morphology.

The local policy framework in place to address a specific pressure to aquatic biodiversity must therefore take multiple factors into consideration: the type of threat, the realm in which it occurs, the main drivers and the spatial and temporal extent (i.e., river connectivity). A one-size-fits-all approach to safeguarding aquatic biodiversity per threat is thus not feasible. Putting the EU policy framework into practice on the local scale demands the consideration of multi-dimensionality, considering which aquatic realms apply or overlap for the same threat (i.e., freshwater and coastal for the Ria de Aveiro) and which single or combination of drivers needs to be addressed by the regulating policies (e.g., species extraction by fisheries in the North Sea and by the fisheries and tourism sector in the Azores). The results of our eight local policy analyses will determine if this approach has been successfully applied.

A detailed analysis for local policy frameworks of each individual case study are presented in the Annex, including:

- A brief description of the case studies in order to highlight the key threats and associated drivers, (sub)pressures and impacts on the state of the aquatic environment.
- An overview of the key policy instruments in the case studies contributing to biodiversity loss or protecting biodiversity.

4 Comprehensiveness of policy framework for aquatic biodiversity at local level

The environmental policy framework to protect biodiversity in aquatic ecosystems is comprehensive at EU level, with the six identified pressures on biodiversity being well tackled by specific policy instruments and by the cross-cutting objectives of policies such as the Birds and Habitats Directives, the Water Framework Directive and the Marine Strategy Framework Directive (Rouillard et al., 2017). These EU policies are transposed at regional and national level in the case studies, and therefore it can be expected that the framework is similarly comprehensive at local level in the case studies. For example, the Austrian section of the Danube River is subject to several national policies and international agreements that address the pressure of morphological alterations by reducing the ecological impacts of hydropower, improving floodplain connectivity, increasing amounts of residual water in waterbodies, as well as monitoring and enhancing transboundary cooperation. These policy instruments link to the Biodiversity Strategy, Water Framework Directive, Birds and Habitats Directives, the Environmental Impact Assessment Directive, the Floods Directive and the Strategy for the Danube Region at EU level. Despite this framework, however, pressures remain on the Danube River, limiting the achievement of good ecological status.

In some case studies, the national/regional/local implementation of different directives acts in synergy, with potential to enhance the effectiveness of each individual policy. For example, the Danube Flood Risk Management Plan promotes natural water retention measures. These measures are an important contribution to flood protection under the Floods Directive, but can also contribute to meeting the objectives of the Water Framework Directive and Birds and Habitats Directives. In the Azores, Regional Legislative Decree no. 36/2008 allows commercial fishers to gain licences for converting to tourism activities using their boats. This works in synergy with the regional decrees that establish marine protected areas in the Azores to protect the biodiversity that is valued by tourists. Therefore, this combination of policies decreases extraction of species while increasing tourism benefits, which further decreases the fishing pressure. In the Ria de Aveiro area, several policies, including the River Basin Management Plan, Flood Risk Management Plan, the Coastal Zone Management Programme for the Ovar-Marinha Grande section and the Vouga River Estuary Development Plan focus on enhancing ecological connectivity to varying extents.

However, some gaps and/or conflicts in the environmental policy framework for a specific threat were also identified. For example, in the Azores, there are two types of marine protected area – Island Nature Parks (established by Regional Decree) within 12 nautical miles of the islands and the Azores Marine Park (also established by Regional Decree) that lies beyond that

limit. The two types have different management authorities, which could result in management measures, such as closing areas to fishing, merely displacing rather than reducing the threat.

Table 4: Environmental policy landscapes across selected pressures to aquatic biodiversity on the local level, based on local case study examples

Pressure	Realm / CS	Driver	Local policy instrument	Key relevant feature	Link to EU policy
Nutrients pollution	Freshwater/ Swiss Plateau	Agriculture	The Federal Assembly of the Swiss Confederation, 1983. Federal Act on the Protection of the Environment (EPA)	Aims to sustain the natural foundations of life, especially biodiversity and soil fertility	HBD
			Federal Office for the Environment (FOEN), 2017. Action Plan for the Swiss Biodiversity Strategy, Bern.	Refers to measures to protect biodiversity in agricultural areas	BD2020
			Swiss Federal Council (1998) Water Protection Ordinance (WPO)	Demands proper operation of industrial and agricultural installations, and informing authorities on monitoring results	WFD
			Federal Office for the Environment (FOEN), 2012. Micropollutants in municipal wastewater, Bern	Add a treatment step to reduce the concentration of polluting substances in wastewater	Urban Waste Water treatment Directive
			Ministry for Agriculture (BLW), 2017. Action Plan for the reduction of pesticides from agriculture	Reduce risks of agro-chemical usage and the river sections not complying with water quality standard by 50% by 2027	Sustainable Use of Pesticides Directive
Extraction of species	Marine/ North Sea/ Netherlands	Commercial fisheries	Ministry of Infrastructure and the Environment, 2012. Marine Strategy for the Netherlands part of the North Sea 2012-2020, The Hague, Netherlands	Management plans for Natura 2000 sites to comprise fishing restrictions	MSFD
			Interdepartmental Directors' Consultative Committee North Sea (IDON), 2005. Integrated Management Plan for the North Sea 2015, Rijswijk, Netherlands	To develop and harmonise sustainable spatial-economic activities in the North Sea	WFD, HBD, MSFD
			Ministry of Agriculture, Nature and Food Quality, 1999. National Ecologic Network	The Government's target is to 6 mil ha of waterscape by 2018	HBD
			State Secretary for Economic Affairs and the State Secretary for Infrastructure and the Environment, 2013 Natural Capital Agenda, The Hague, Netherlands	By 2020 aquaculture and fisheries meet international sustainability criteria for stock management and biodiversity	BD2020, HBD, CFP, MSFD, CAP
			Ministry of Agriculture, Nature and Food Quality, 2017. Nature Conservation Act, The Hague, Netherlands.	Regulates the use of nature areas, wild animals and plants	BHD
Water Abstraction	Coastal/ IBRM	Agriculture	Ministry of Environment and Planning Andalusia, 2015. Plan for the Recovery and Planning of Network of Cattle and Green Corridor Routes, Seville, Spain.	Aims to preserve cultural heritage, support livestock raising, ensure ecosystem connectivity for biodiversity conservation	BHD
			Ministry of Environment and Planning Andalusia, 2010. Andalusian Strategy for Integrated Management of Biodiversity, Seville, Spain.	Promotes sustainable development model that considers value of biodiversity and reinforces its role as natural capital	BHD
			Ministry of Environment and Planning Andalusia, 2016. Master Plan for Ecological Connectivity in Andalusia, Seville, Spain.	Central coordination instrument for ecological connectivity in Andalusia, for the coherence of Natura 2000 network	BHD
			High Commission for Waters and Forests and the Fight against Desertification, 1996. National Plan for Watershed Management, Rabat, Morocco.	Defines priorities for management between the basins and the interior of the basins	WFD

			Ministry of Energy, Mines and Sustainable Development, 2017. National Strategy and Action plan for Biodiversity of Morocco 2016-2020, Rabat, Morocco.	Protection, preservation and rehabilitation and the optimization of the exploitation of biodiversity	BD2020
			Ministry of Environment and Planning Andalusia, 2011. IBRM Action Plan 2011-2015, Seville, Spain.	Defines the strategic lines for the optimal implementation of the IBRM	INTERREG
Invasive Alien Species	Freshwater/ Lough Erne	Tourism	The Heritage Council, 2007. National Invasive Alien Species Database, website: http://invasives.biodiversityireland.ie	Compile and communicate species distribution data to inform local action	Invasive Species Regulations
			Environment and Heritage Service, 2004. Zebra mussel management strategy for Northern Ireland 2004 – 2010, Belfast, Ireland	Aims to minimise spread of zebra mussels from Lough Erne to unaffected water bodies	
			Department for Culture, Heritage and the Gaeltacht, 2017. Ireland's 3rd National Biodiversity Plan 2017-2021	Control harmful IAS and reduce the risk of new species spreading	BD2020
			Kelly, J. and Maguire, C.M., 2008. Water Users Code of Practice. Prepared for NIEA and NPWS as part of Invasive Species Ireland.	Voluntary code of practice for water users to reduce spread of IAS to unaffected waterbodies on equipment	Invasive Species Regulations
			Northern Ireland Environment Agency, 2015. North Western River Basin Management Plan, Lisbon, Ireland	Includes actions to implement NI's IAS strategy, research their effects on the aquatic environment and assess impacts of specific species	WFD
			Lough Erne Landscape Partnership (LELP), 2017. Conservation Land Management Strategy Lough Erne, Co Fermanagh, Ireland	Liaise with partners and develop citizen science projects to monitor and record IAS locations	Invasive Species Regulations
Alteration to morphological conditions of aquatic habitats	Freshwater/ Danube River/ Austria	Energy	The Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2014. Austrian biodiversity strategy 2020+, Vienna, Austria.	Measures for revitalising, modernising and increasing efficiency of hydropower plants while simultaneously improving ecological conditions	BD2020
			International Commission for the protection of the Danube (ICPDR), 2015. Danube River Basin District Management Plan – Update, Vienna, Austria.	Legal/political framework for cooperation and transboundary management	WFD
			The Federal Ministry of Sustainability and Tourism, 2015. Austrian National Water Management Plan 2015, Vienna, Austria.	Measures to increase residual amounts of water in water bodies	WFD
			The Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2017. The Austrian National Park Strategy, Vienna, Austria.	Reduction of the impacts of hydroelectric power stations and water use	BHD, WFD
			Federal Government, 1996. Environmental Control Act, Vienna, Austria.	Monitoring of environmental changes, publishing of results for local and national authorities and the public, Environmental Control Report published every three years	Environmental Impact Assessment Directive
			The Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2015. Floodplain strategy for Austria 2020+, Vienna, Austria.	Focus on connectivity of floodplains and securing flood plain areas	Floods Directive
			Ministry for Transport, Innovation and Technology, 2015. Action programme Danube 2022, Vienna, Austria.	Integrative strategy including objectives and a programme of measures for navigation, ecology and flood protection	EU Strategy for Danube Region

5 Relationship between trends in drivers and aquatic biodiversity

Despite the comprehensive environmental policy framework in place at local level in the case studies, the future development of the selected drivers (commercial fisheries, energy, agriculture and tourism), supported by sectoral policies, could negatively impact aquatic habitats and cause further biodiversity loss across the EU. In an effort to determine future trends in pressures on aquatic biodiversity and to illustrate the challenge for European society and policy-makers attempting to reduce aquatic biodiversity loss, the economic outlook for the four drivers at case study level is assessed in Table 5. In the majority of cases, the drivers are anticipated to remain the same or increase in economic importance. Only commercial fishing in the Dutch North Sea is anticipated to decline. The economic significance and future trends for these drivers are explored in more detail in subsequent sections.

Table 5: Local economic trends for drivers of pressures causing aquatic biodiversity loss across case studies

Driver	Case Study	Significance to local Economy	Future trends
Commercial fisheries	Marine/ North Sea/ Netherlands	In 2012, the Dutch fleet generated an income of 364 million EUR. This stemmed from 358 million EUR in landings and around 5.9 million EUR in non-fishing income. In 2013, the total amount of Gross Value Added (GVA) by the Dutch national fleet reached 139 million EUR (STECF, 2015). However, fisheries represent less than 0.1% of the Dutch GDP and employment in the fisheries sector reached 1,773 full time jobs in 2012 (EC, n.d.).	↘
	Coastal/ Aveiro River	6% of all fish landing in continental Portugal occur in the port of Aveiro, one of the ports with highest activity in the country (EC, 2010a). In 2009, registered fishermen in Aveiro were 865 inland and 718 maritime fishermen, and capture was 10,696t, corresponding to 13,043,000 EUR. The relative abundance and increase in commercial value may lead to an increase in activity. (APA, 2016).	↗
	Marine/Azores/ Faial-Pico Channel	6% of caught fish in Portugal is landed in the Azores (Ojamaa, 2015). In 2013 the Azorean fleet included 766 vessels. The Azores were identified as one of the 30 regions with the highest dependence on fisheries in the European Union (Ojamaa, 2015). At the Azores-level, commercial fishing employs 1.5-3.2% of workers and the value of nominal fishing catch is equivalent to 0.7% of Azorean Gross Value Added (Statistics Portugal, 2017, Ojamaa, 2015). Local fish market prices show a fluctuating but upward trend (Statistics Portugal, 2017).	→
Energy	Marine/ North Sea/ Netherlands	Existing offshore wind farms and those under construction have a capacity of approximately 1,000 MW. Thus, offshore wind energy in the Netherlands is expanding significantly, with a plan towards 4500 MW offshore wind power foreseen until 2019 (700MW/year) (Netherlands Enterprise Agency, 2015). This means that by 2023, offshore wind farms will generate 3.1% of total energy used in the Netherlands (Government Netherlands, n.d.).	↗
	Freshwater/ Danube River/ Austria	Hydroenergy produces 56.6% of Austria's total energy (EEÖ, 2018). In most Danube countries (except for Germany, Hungary and and Moldova), hydropower contributes more than 45% of renewable energy production. Electricity production from hydropower will increase in most countries, but the share will not (ICPDR, 2013).	↗

	Coastal/ Aveiro River	The Ria de Aveiro is affected by 5 hydroelectric infrastructures upstream from the Natura 2000 protected area (APA, 2016). High pressure (in terms of run-off, section of waterline < 1 km) due to hydroelectric structures (e.g., structures of Palhal and São Pedro do Sul) could affect hydrology downstream in CS area. No further installations are expected (APA, 2016).	→
	Freshwater/ Swiss Plateau	The building and maintenance of hydropower plants has greatly contributed to morphological alterations in the Swiss Plateau. Renewable energy production from hydropower within Switzerland is the most important domestic source of renewable energy and covers 56% of the national energy needs (SFOE, 2017). The Federal Energy Act aims to increase the average annual production of electricity from hydropower to 38,600 GWh by 2050 (by 2035 to 37,400 GWh), as part of its Energy Strategy 2050 SFOE, 2017).	↗
Agriculture	Freshwater/ Lough Erne	Fermanagh and Omagh county possess 201,470 ha of rough grazing and grass and 726 ha of cropland. Between 2015 and 2016, both dairy and beef cattle numbers increased by 2 and 4% respectively (DAERA, 2017). The value of agriculture for wards in the Northern Irish part of the Lough Erne catchment is estimated at €143 million/year (DAERA, 2018).	→
	Coastal/ IBRM	Spain: In 2015, 4.22 billion m^3 was distributed to agricultural holdings in Andalucia (30% of total amount of water distributed in Spain that year) (INE, 2015). Malaga and Cadiz add 7.9% and 5% of agricultural input for Andalusia in 2016 (Andalusia Regional Government Ministry of Agriculture and Fishing, 2017).	↗
		Morocco: 20 billion m3 of waster consumed by Agriculture at national level (80% surface water, 20% groundwater) (Ministry of Agriculture, Rural Development and Maritime Fisheries of Morocco, 2017). Value added from agricultural in 2016 was 12%. Average GDP from agriculture (2008-2016) €9.21 billion; +47% over the average from the 2000-2008 period. Agriculture account for 39.3% of employment at national level; 74.5% in rural areas (Ministry of Agriculture, Rural Development and Maritime Fisheries of Morocco, 2017).	↗
	Coastal/ Aveiro River	Smallholder agriculture: 41% decrease in number of Agricultural Holdings 1989-2009. Livestock raising: 23% increase in livestock units 1989-1999 followed by decrease of 12% between 1999-2009. 59% of agricultural area is utilised, with 27% irrigated. (Sousa et al 2015, APA, 2016).	↗
	Freshwater/ Swiss Plateau	Agriculture's share in the gross value added of the Swiss economy fell from 1.5% to 0.7% between 1995 and 2013 (FSO, 2015). Agriculture's share in the gross value added within the primary sector amounted to 91% (FSO, 2015). Overall, a reduction in the number of farms and people working in the industry, due to technical progress can be seen. Between 1996 and 2013, the number of Swiss farms decreased from 79,500 to 55,200. However, at the same time the average area used for agricultural activities per farm increased by 5.4 hectares and now covers 19 hectares (this represents an increase of 40%). Between 2000 and 2013 the utilised agricultural area declined by 22,600 hectares (FSO, 2015).	→
Tourism	Freshwater/ Lough Erne	The tourism sector generated £58.8 million in County Fermanagh and supported 3448 jobs in Fermanagh and Omagh counties in 2013 (Fermanagh and Omagh District Council, 2015). Approximately 25,000 angling licences are sold annually. The number of non-resident licences issued is gradually increasing. In 2014, visitors participating in coarse angling matches in Lough Erne generated £630,000 in 2014 (Inland Fisheries Group, 2015). Recreational boating is popular, although there is no comprehensive data on uses and trends in Lough Erne. In 2015, 730 boats entered Lough Erne through the Shannon Erne waterway (TTC, 2014).	↗
	Coastal/ Aveiro River	Tourism provides 6% of employment in the Ria de Aveiro region. (Albuquerque, 2013). Water sports are expected to increase as traditional activities (e.g., saltpans) are abandoned in favour of tourism activities (Dolbeth et al. 2016). Between 2002-2012, there was an increase in value of the regional tourism offer more than doubled, from 78,177-175,996 guests (Sousa et al. 2015).	↗
	Marine/ Azores/ Faial-Pico Channel	While tourism is not yet driving biodiversity loss, it is one of the most significant local economic drivers, with visitor nights in Faial-Pico growing at 5.1% per year between 2001-2016 (SREA, 2018). Associated pressures may mean tourism begins to drive biodiversity loss in the future.	↗

5.1 Commercial fisheries

At EU level, catches from commercial fisheries have declined across the EU. This is leading to increase imports of high value species to address the continuous demand for fish consumption in the continent (EEA, 2015b). Across the EU, the commercial fisheries sector provides 152,720 direct jobs, which overall represents a very small fraction of EU population, when compared to other sectors, such as agriculture (at around 10 million people) (STECF, 2017, Eurostat, 2017a). Nevertheless, when assessing the importance of commercial fisheries at the local level, it becomes evident that the sector is significant to the local socio-economy in certain coastal areas.

In countries with high dependencies on the fishing activities (i.e., Portugal, Spain), the sector (including ancillary sector) can make up close to half of local employment in coastal regions (EC, 2016). In the AQUACROSS case studies North Sea, Ria de Aveiro and the Azores, commercial fisheries are important economic sectors. For example, the harbour town of Aveiro (Aveiro case study) was identified as and subsequently studied as an example of a highly fisheries-dependent European community, that accounts for 6% of all Portuguese fish catches landed, with 865 inland and 718 maritime registered fishermen (APA, 2016). However, this number does not reflect the true socioeconomic relevance of employment stemming from the sector as it does not account for those employed in shipyards and shipbuilding, cold storage, processing factories, the manufacture and maintenance of fishing gear, etc., for which data are lacking (Ojamaa, P., 2015). An increase in fish prices is expected to fuel an increase in catches in the future (APA, 2016).

Similarly, in the Faial-Pico Channel in the Azores, commercial fisheries are traditionally central to local employment. Overall, the Azores have been identified as one of the 30 most fisheries-dependent regions in the EU (Ojamaa, 2015). In particular, long-line pelagic fisheries are common in this area, which catch high value fish species, such as tuna (Pham et al. 2013). Longline fisheries can cause high numbers of discards for non-target fish, turtles and other marine life, which tend to mistake bait for food sources and get entangled on the lines or suffocate after swallowing the bait (Pham et al. 2013).

Landings in Faial-Pico Channel have decreased over recent years, with local stakeholders pointing to a reduced availability of fish in the area (D9.2). Local Azorean policy initiatives aim to support the transfer of employees from the fisheries to the tourism sector in Faial-Pico, to reduce the pressure of extraction of species. Overall, it is unclear how commercial fisheries will evolve in Faial-Pico Channel. The economic importance of fisheries might decrease, if current fish decreases continue and due to due to an employment shift to tourism activities, but could also increase if fish prices continue to rise and make commercial fishing more profitable again.

Regarding the Dutch North Sea, revenues represent less than 0.1% of the national GDP (EC, n.d.). Nevertheless, the North Sea has historically been fished intensively, in particular with bottom trawling fishing gear, which leads to morphological disruptions of the seafloor and overfished stocks (De Groot, 1984). However, compared to other European seas, fish stocks

are growing in the North Sea, as the proportion of large demersal fish has recovered to around 22% in 2008 from only 5% in 2001. This is an improvement, but still indicative of overfished stocks (OSPAR, 2010).

5.2 Renewable Energy

Renewable energy production is continuously increasing in Europe as Member States are moving away from fossil fuel based energy provision to renewable energy sources to mitigate climate change, but also to increase national energy independence, by not having to rely on oil and gas imports (Böhringer and Keller, 2011). In 2016, renewable energies supplied about 17% of primary energy production in Europe (Eurostat, 2018). Hydropower is the second most important contributor to renewable energy (14.3% of mix in 2016), but its development has remained relatively stable over recent years. The construction of hydropower plants has significantly altered the morphology of waterways and reduced longitudinal river continuity in these different regions and realms, which severely impacted the conservation status of migratory fish species in those regions, as these species are inhibited in their river ascent/descent (Fette et al. 2006). The construction of new hydropower plants will further reduce longitudinal river continuity in affected locations.

Renewable energy production from hydropower is predominantly relevant in the Danube river and Swiss Plateau case studies. In most Danube countries (except Germany, Hungary and Moldova), hydropower contributes more than 45% of renewable energy production, and covers 56.6% of the national energy needs in Austria (ICPDR, 2013, EEÖ, 2018). In the future, hydropower energy production is expected to increase in most Danube countries (ICPDR, 2013). In Switzerland, hydropower covers up to 56% of national energy needs and the federal Energy Strategy 2050 aims to increase the average annual production of electricity from hydropower to 38,600 gigawatt hours (GWh) by 2050 (SFOE, 2017).

The construction of offshore wind farms has significantly expanded in recent years. Between 2016 and 2017, wind power capacity grew by 25% across the EU and offshore wind installations grew by 101% (WindEurope, 2017). The OECD predicts that the offshore wind industry will create around 170,000 jobs by 2020 and 300,000 by 2030 in Europe alone (OECD, 2016). The continued construction of new offshore platforms will alter seabed morphology, which will likely have significant adverse effects on marine biodiversity, in particular seabed habitats.

On the other hand, renewable energy production from offshore windfarm is an increasingly important sector in the Dutch North Sea. In the Dutch part of the North Sea, a rapid increase in offshore windfarm implementation is underway. Currently, the Dutch offshore windfarm capacity (existing and under construction) is approximately 1,000 MW. It is foreseen that by 2019 their capacity will increase to 4500 MW (Netherlands Enterprise Agency, 2015). By 2023, Dutch offshore windfarms will generate over 3% of the national energy budget (Government Netherlands, n.d.).

5.3 Agriculture

Agricultural activities cover 41.1% of the total EU surface (Eurostat, 2017b) and support the employment of around 10 million people, which makes 5% of total employment (EC, 2013). Furthermore, the GVA of the agricultural sector was 165.7 billion EUR in 2016 (Eurostat, 2017c). Since the 1950s, agriculture production across the EU has intensified, mainly based on an increased use of fertiliser, which on the one hand strengthened agriculture productivity while simultaneously causing major nitrogen and phosphorus pollution of EU waters across realms (eutrophication occurs from inland freshwaters to coastal waters) (Lassaletta et al. 2014). While fertiliser use has decreased between 1990 and 2005, predictions for the future EU trend foresee an increase in agricultural production, which in turn will likely increase nutrient emissions (Bouraoui and Grizzeti, 2011).

In our case studies, eutrophication caused by nitrogen and phosphorus fertilisers remains an issue in the Lough Erne catchment, in Sweden and the Swiss Plateau. In Lough Erne, the agricultural value is estimated at 143 million EUR per year (DAERA, 2018). At national level in Switzerland, agriculture's share in the gross value added within the primary sector amounted to 91% (FSO, 2015). Most agriculture in Switzerland takes place in the Swiss Plateau, where it represents the main land use (49.5%) (FSO, 2013). The use of nitrogen fertilisers stayed constant (and high) between 2002 and 2013 (FOEN, 2014). Hence, in both regions nutrient enrichment is likely to persist and cause ongoing pressures to aquatic biodiversity related to eutrophication.

In addition to nutrient enrichment, the agricultural sector is responsible for major water abstraction across the EU for irrigation purposes. Due to an improvement of irrigation techniques, water abstraction in the agricultural sector is declining in the EU (it declined by 7% between 2002 and 2014) (EEA, 2017). However, increased droughts under climate change will contribute to water scarcity and likely cause an increase in water abstraction for agriculture in the future (IEEP, 2000). Water abstraction practices cause morphological changes to aquatic habitats from which the water is withdrawn and can also inhibit longitudinal continuity of rivers (DEFRA, 2013).

In the Ria de Aveiro basin, irrigation plays a major role for agriculture with 27% of the basin being irrigated (Sousa et al. 2015, APA, 2016). In the IBRM, water abstraction for agricultural purposes is a significant pressure on biodiversity in the coastal realms of Andalusia (Spain) and Morocco. For example, 4.22 billion m3 of water was distributed to agricultural holdings in Andalusia in 2015 alone. At the same time, agriculture is a major sector, representing for instance in Morocco up to 75% of employment in rural Morocco (Ministry of Agriculture, Rural Development and Maritime Fisheries of Morocco, 2017).

5.4 Tourism

Tourism in the EU employs 12.3 million people and is therefore a major economic sector (Eurostat, 2017d). Tourism numbers have continuously increased over recent years and have

risen by 30% between 2002 and 2012. While this has positive effects on local incomes, it also leads to changes that place pressures on biodiversity, such as alterations in coastal regions through construction (Eurostat, 2015), an increase in water needs, nutrient pollution and transport of invasive species. Furthermore, an increase in coastal tourism leads to a rise in coastal recreational activities, which can have various impacts on local biodiversity.

Tourism is a relevant driver in the Ria de Aveiro, Lough Erne and Azores case studies. In both the Aveiro case study and the Azores case study, a shift from traditional employment activities (such as saltpans and fisheries) towards tourism is occurring (Dolbeth et al. 2016, SREA, 2018). This is reflected in an increase in tourism numbers over recent years. In the Ria de Aveiro region (Aveiro case study), 6% of local employment depends on tourism and an increase in value of the regional tourism offer more than doubled between 2002 and 2012 (from 78,177 to 175,996 guests) (Sousa et al 2015). In the Azores case study, visitor nights grew annually by 5.1% between 2001 and 2016 (SREA, 2018). Pressures to aquatic biodiversity arising from the increasing numbers in tourism are not yet clearly defined nor documented.

In the Lough Erne region, the tourism sector majorly supports the local economy, as it generated £58.8 million in County Fermanagh and supported 3448 jobs in Fermanagh and Omagh Counties in 2013 (Fermanagh and Omagh District Council, 2015). The main pressure arising from the driving force of tourism in Lough Erne has been identified to be an increase in the spreading of aquatic non-indigenous species through recreational boat traffic (LELP, 2017).

Overall, across the eight case studies, our analysis of future trends in the four major drivers to aquatic biodiversity loss identifies that current growth in these sectors will continue. This will place additional pressure on aquatic biodiversity in the case studies, and place additional pressure on existing environmental policies. In the following, we will more closely examine how local drivers are strengthened through legislative action to deduce negative impacts and restrictions to biodiversity protection based on the local policy framework.

6 Promotion of drivers of aquatic biodiversity loss

In the previous section, we identified that trends in drivers to aquatic biodiversity loss are largely stable or increasing across case studies. We now review how local-level sectoral policies promote aquatic biodiversity loss by increasing the amount of economic activity. Rouillard et al. (2017) (D2.1) identified two main types of driver-promoting policies, which act:

- By encouraging or promoting a direct change of sectoral practices that leads to an increase the pressure (direct regulation); and
- By directly supporting a driver through funding mechanisms that, ultimately, lead to an increase of the pressures to aquatic biodiversity (direct support).

Examples of these two policy types at the local level are discussed below

6.1 Direct regulation: promoting a direct change of sectoral practices

6.1.1 Direct promotion of economic sectors that leads to a increase of the pressure

Several EU policies were identified to be directly supporting the main drivers affecting aquatic biodiversity (commercial fisheries, energy, agriculture and tourism). These EU policies are translated into national legislation at Member State level, as well as other national/regional/local level legislation that promote identified drivers. Table 6 shows examples of national/local policies that are linked to EU policies and support drivers at the local level.

At EU level, the Common Fisheries Policy supports coastal small-scale fisheries and aquaculture practices in line with supporting food security, growth and limiting local unemployment. Similarly, the Blue Growth Strategy supports the extraction of marine living resources to boost the blue economy. Even though it focuses on "sustainable uses", it primarily focuses on supporting commercial fisheries. At the local level, EU Member States have implemented the CFP through national fisheries legislation. The Netherlands put into force a North Sea 2050 Spatial Agenda, which on the one hand aims to identify and reduce spatial conflicts of different marine users and increase sustainability, but it also has a clear long-term target of economic growth. In the Azores, the CFP is implemented through Azorean fisheries legislation. Portugal has also defined a Portuguese National Ocean Strategy, which is strongly linked to the EU Blue Growth Strategy. In mainland Portugal, the Aveiro case study region's fishing fleet is supported

in addition by an operational programme under the European Maritime Fisheries Fund – EMFF, the Mar2020. Overall, local legislation implementing and supporting the CFP and Blue Growth Strategy will consequently support the driver of commercial fisheries and hence sustain species extraction, even if a focus lies on sustainability.

We find that local level implementation of European renewable energy directives places pressure on local aquatic biodiversity. At the EU level, the Directive on the promotion of the use of energy from renewable resources (2009/28/EC) requires Member States to adopt national renewable energy action plans setting targets for the share of energy from renewable sources. The promotion of renewable energies, either offshore wind or hydropower constructions, impact morphological conditions of the aquatic habitats that they are constructed in.

In the North Sea, Member States are turning towards a stronger development of offshore wind, to achieve the targets. The Dutch North Sea 2050 Spatial Agenda, already discussed above for fisheries, assesses the potential of renewable energies offshore. Furthermore, the Netherlands have defined a number of national legislations that specifically focus on renewable energies, such as the National Renewable Energy Action Plan, the Offshore Wind Energy Act and the Energy Agreement for Sustainable Growth, which together aim for more wind energy in the Dutch North Sea with an offshore wind capacity of 4,450 MW to be operational by 2023.

In the Danube river basin, hydropower constructions already significantly contribute to the national energy production. In some Danube basin Member States hydropower will be expanded to increase energy production from renewables. The Austrian government defined the National Renewable Energy Action Plan and Green Electricity Act 2012 that aims for a higher share of renewables, such as a target of 71% of electricity demand to be met by renewables in 2020. This may have an increasing effect on the driver, if hydropower is increased to meet the renewable energy demand of the country. In the Ria de Aveiro basin, the Portuguese National Action Plan for Renewable Energy 2013-2020 (PNAER 2020) supports an increase in renewable energies, which is likely going to increase renewable energy structures. Though no new structures are planned for within the case study area, the nature of hydropower's impact of hydrological parameter implies that any upstream infrastructures may impact the area and lead to further alterations to hydromorphology. . Even though the EU renewable energy policies do not apply to Switzerland, the country has been very ambitious to promote renewable energy production from hydropower, leading to similar pressures on aquatic biodiversity in the freshwater realm. The Swiss Energy Strategy 2050 aims for an increase in the average annual production of electricity from hydropower to 38,600 gigawatt hours (GWh) by 2050.

The Commission Communication 'Europe, the world's No. 1 tourist destination – a new political framework for tourism in Europe' (COM2010/0352) promotes tourism as a driver for economic growth in EU countries. This Communication has triggered policies supporting tourism growth in Member State. For example, the General Plan for Sustainable Tourism of Andalusia aims to reduce the region's dependency on beach tourism, by promoting nature tourism activities with the Andalusia Protected Areas Network. Nevertheless, new pressures might arise in the protected areas, if the number of tourists is supported by legislation in these locations. In the

Lough Erne, several policies play together and support tourism growth, such as the Draft Northern Ireland Tourism Strategy and the Fáilte Ireland Tourism Development and Innovation Strategy for Investment (2016-2022). The policies aim to increase visitor numbers and revenues to support the creation of new jobs locally. In the Aveiro river basin, the Portuguese Tourism Strategy 2027 aims to set out Portugal as a competitive tourism destination. In the Azores, the Strategic and Marketing Plan of the Azores Tourism and the Tourism Development Plan in the Autonomous Region of the Azores both aim to increase tourism. In addition, the Azores implemented an Air Passenger Transport Model for air space liberalisation (29 March 2015), which allows increased air traffic and hence increasing visitor numbers to the islands. Overall, the local policies supporting the tourism industry mainly focus on increasing economic growth with few environmental safeguards, thereby contributing to intensify a range of pressures (e.g., additional nutrient pollution, extraction of species, morphological alterations) on aquatic ecosystems.

6.1.2 Conflicts between sectoral and environmental policy at the local level

The policy analysis in the AQUACROSS case studies shows, that sectoral and environmental policy targets can be conflicting each other, or that their implementation will lead to a local conflict. Examples of such conflicts are described below.

In the Lough Erne case study, Northern Irish policies as well as those at local level seek to promote tourism, which is a driver of invasive species introductions through recreational boating and fishing. For example, at local level the Fermanagh Lakelands Tourism Area Plan for 2013 to 2020 aims to increase tourist trips, nights and spend in the Fermanagh Lakes area (which includes Lough Erne) between 2013 and 2020. The current trend in these parameters is considerably below the target, leaving much scope for them to increase further. Recreational boating and fishing are important sources of tourism income and economic activity, but are also key vectors for introduction of invasive alien species. Therefore, the promotion of tourism without additional policy threatens the achievement of the objectives of several environmental policies in the area, such as the target in the North Western River Basin Management Plan 2015-2020 to reduce pressures from invasive alien species in surface water bodies. However, other voluntary initiatives, such as the Water Users' Code of Practice in place in the island of Ireland, seek to mediate this conflict between environmental and sectoral policy by reducing the extent to which tourism introduces and spreads invasive alien species.

Policy conflicts in the Ria de Aveiro case study also relate to tourism. The Tourism Strategy 2027 promotes nature-based tourism, particularly in protected areas such as Natura 2000, managed under the Sectoral Plan for the Natura 2000 network. While both policies promote the maintenance and protection of these areas, their uses for nature conservation and for tourism may be in conflict.

6.1.3 Environmental safeguards in sectoral policy

In opposite to the conflicts described above, some AQUACROSS case studies have also shown examples of good practices, where environmental safeguards are put in place to reduce potential negative impacts on the environment.

The Marine Strategy for the Netherlands part of the North Sea 2012-2020 aims to, amongst other things, prevent the harmful effects of noise from underwater human activities. To this end, it aims to set new conditions for permits for pile-driving for windfarms, such as requiring noise abatement measures.

In the Azores, several measures are in place to restrict fisheries exploitation, including limited licensing for demersal and deep-sea species and restrictions on area, gear, vessel size, and landing size and weight. Spatial exclusion bans are also in place in three biodiverse areas in the Faial-Pico channel, with some exceptions. As mentioned above, under the Regional Legislative Decree 36/2008, fishers are also able to gain licences to use boats for tourism instead of fisheries, enabling them to earn income from activities other than commercial extraction of species.

Table 6: Examples of EU policies and their corresponding local policies contributing to the intensification of pressures on aquatic biodiversity through the strengthening of drivers at the local level

Driver	European Policies supporting drivers	Realm / CS	Example of local policy	Local policy objectives
Commercial fisheries	Common fisheries policy	Marine/ North Sea/ Netherlands	Ministry of Infrastructure and the Environment, 2014. North Sea Spatial Agenda 2050, The Hague, Netherlands	Aims to identify the best spatial use of the North Sea until 2050, consulting between parties from nature, fishing, mariculture, shipping, energy, tourism and recreation.
	And Commission Communication 'Blue Growth – opportunities for marine and maritime growth' (2012)	Marine/ Azores/ Faial-Pico Channel	Legislative Assembly of the Azores, 2010. Regional Legislative Decree No. 29/2010 A of November 9, Horta, Azores	Sustainable management of fisheries in the Azores and of the fishing industry.
			Legislative Assembly of the Azores, 2012. Regional Legislative Decree No. 31/2012/A of July 6, Horta, Azores	
		Marine/ Azores/ Faial-Pico Channel	Directorate General for Maritime Policy, 2014. National Ocean Strategy 2013-2020, Portuguese Government, Lisbon, Portugal	Strategy focuses on Blue Growth, including the management of living resources (fish and shellfish).
		Coastal/Aveiro River	Council of Ministers Portugal, 2015. Resolution of the Council of Ministers no. 16/2015, of April 2, Lisbon, Portugal	Aims to support socioeconomic development of the central region. Supports the adjustment of fishing effort to the available fishing resources, the use of more selective fishing gear, fleet modernisation,
Energy	EU Renewable Energy Directive	Marine/North Sea/ Netherlands	Ministry of Infrastructure and the Environment, 2014. North Sea Spatial Agenda 2050, The Hague, Netherlands	Examines the opportunities and problems of multiple use of the sea (link to 'Blue Growth' strategy).
			Ministry of Economic Affairs and Climate Policy, 2013, Energy Agreement for Sustainable Growth, The Hague, Netherlands	4,450 MW of offshore wind capacity will be operational by 2023.
			Ministry of Foreign Affairs, 2010. National Renewable Energy Action Plan, The Hague, Netherlands,	Aims to increase number of wind farms.
			Ministry of Economic Affairs; Ministry of Infrastructure and Environment, 2015. Netherlands Offshore Wind Energy Act, The Hague, Netherlands	The government is responsible for choosing a location for the proposed plant, and assure that construction and operation is aligned with all governmental institutions and grid connection.
		Freshwater/ Danube River	Federal Ministry of Economy, 2010. National Renewable Action Plan, Vienna, Austria	34% of energy share generated from renewable sources in gross final energy consumption.
			Federal Ministry for Science, research and Economy, 2012. Green Electricity Act 2012, Vienna, Austria	By 2020, 71% of electricity demand to be met by renewables (15% by 2015), which may be met with hydropower increase.
		Coastal/ Aveiro River	Ministry for the Economy, Innovation and Development, 2010. National Renewable Energy action Plan (NREAP), Lisbon, Portugal,	Includes economic, social and environmental aims. Promotes resource efficiency (energy, water and solid waste) in tourism companies.

		Freshwater/ Swiss Plateau	Swiss Federal Office of Energy, 2017. Swiss Energy Act – Energy Strategy 2050, Bern, Swiss Confederation	Promotes renewables and energy efficiency, mainly cost-covering remuneration scheme for electricity generated from renewables.
Agriculture	Common Agricultural Policy	Freshwater/ Lough Erne	Department of Agriculture and Rural Affairs, n.d.. Common Agricultural Policy (Northern Ireland), Belfast, Northern Ireland	Provides direct support to farmers if basic rules, including environmental rules, are respected (cross-compliance and greening).
			Department of Agriculture and Rural Development, 2015. Common Agricultural Policy Basic Payment and Support Schemes Regulations (Northern Ireland) 2015, Belfast, Northern Ireland	Implements the EU Regulation and specifies the application in Northern Ireland of those articles for which Member States must make decisions.
		Freshwater/ Swiss Plateau	Federal Office for Agriculture, n.d. Swiss Agricultural Policy, Bern, Swiss Confederation	The Swiss equivalent to CAP aims to strengthen agricultural production and improve farm incomes.
Tourism	Commission Communication 'Europe, the world's No. 1 tourist destination – a new political framework for tourism in Europe', 2010	Coastal/ IBRM	Andalusia Regional Government Ministry of Agriculture and Fishing, 2017. Agricultural Income of Andalusia: Advance year 2016, Estimation to September 2017, Seville, Spain.	Promotion of national natural resources and nature tourism (including specific mentions to the Andalusian Protected Areas Network). Objective of reducing dependence of beach tourism.
		Freshwater/ Lough Erne	Andalusia Regional Government Ministry of Tourism and Sports of Andalusia regional government, 2006. General Plan for Sustainable Tourism of Andalusia, Spain, Seville	Aims to increase growth of tourism sector, particularly in numbers of international visitors, through a number of measures
			Northern Ireland Government, 2017. Northern Ireland Programme for Government, Belfast, Northern Ireland.	The previous strategy aimed to increase visitor numbers and earnings. The effect of the current version is assumed to be the same.
			Department for the Economy, 2017. Draft Northern Ireland Tourism Strategy, Belfast, Northern Ireland	Aims to deliver sustainable growth in the tourism industry and increase jobs, foreign earnings and the economic contribution of tourism.
			National Tourism Development Authority, 2016. Fáilte Ireland Tourism Development and Innovation Strategy for Investment, 2016-2022. Dublin, Ireland	Aims to increase visits by 17% between 2013 and 2020 and to increase spend to £50m by 2020.
		Coastal/ Aveiro River	Fermanagh & Omagh District Council, 2015. Fermanagh Lakelands Tour-ism Area Plan, Lisnamallard, Omagh, Ireland.	Sets out to position Portugal as a competitive and sustainable tourist destination. Reach 80 million overnight stays and achieve 26 billion EUR in revenue by 2027.
		Marine/ Azores/ Faial-Pico Channel	Ministry of Economy, 2016. Tourism Strategy 2027, Lisbon, Portugal	Establishes measures to increase amount and positive impact of tourism.
			Regional Directorate for Tourism, 2016. Strategic and Marketing Plan of the Azores Tourism (PEMTA), Horta, Azores	Promotes balanced economic and social development through tourism.
			Regional Directorate for Tourism, 2008. Strategic and Marketing Plan of the Azores Tourism (PEMTA), Horta, Azores	Allow more flights and entrance of low-cost carriers to the Azorean airline market
			Legislative Assembly of the Azores, 2015. Decree-Law no. 41/2015 of March 24 in conjunction with Ordinance no. 95-A/2015 of March 27, Horta, Azores	Allows commercial fishermen to gain licenses to use their boats for tourism activities, such as whale watching or touristic fishing.

6.2 Direct support: funding mechanisms to drivers that increase pressures to aquatic biodiversity

We consider five key EU financing instruments whose implementation at the local level has the potential to support drivers of biodiversity loss: Common Agricultural Policy (CAP), European Agricultural Fund for Rural Development (EAFRD), European Regional Development Fund (ERDF), European Social Fund and Cohesion Fund (CF), European Maritime and Fisheries Fund (EMFF). In this section, we explain the aims of each financing instrument and illustrate through examples how its implementation at the local level can drive or support the fight against aquatic biodiversity loss.

The expansion of agriculture and the linked pressures of nitrogen pollution and water abstraction is promoted through the funding scheme of the Common Agricultural Policy (CAP), which sets conditions for farmers to produce food. The CAP is mainly implemented in EU Member States through funding mechanisms, such as the European Agricultural Fund for Rural Development (EAFRD) and European Regional Development Fund (ERDF). Most EAFRD payments are ultimately designed to support agricultural productivity and employment with few environmental conditionalities (cross-compliance), while a fraction of ERDF payments are directly linked to more environmental friendly farming practices (so-called agri-environmental schemes). In Lough Erne in the Enniskillen area, agricultural beneficiaries in this area received 25 million GBP in direct CAP payments. This can be compared to 3.9 million GBP in agri-environmental payments paid across the whole of Northern Ireland. CAP subsidies mainly support the local pastures, which are a major source of nutrient loading to the lough (NIEA, 2016).

The European Regional Development Fund (ERDF) aims to strengthen economic and social cohesion in the EU by correcting imbalances between its regions. For example, the ERDF co-funds the Danube Transnational Programme, with one of four priorities focusing on "Better connected and energy responsible Danube Region" and with the expected impact to improve energy security and energy efficiency (EC, 2014a). Similarly, the ERDF co-finances the North Sea Region Programme, with the first priority being 'Thinking Growth – Supporting growth in the North Sea Region economies by promoting business investment in research and innovation' (EC, 2014b).

The Cohesion Fund is directed towards countries whose Gross National Income per capita is less than 90% of the EU average in order to reduce economic disparities across European countries. Of the selected case studies, the Azores under the umbrella of the Operational Programme of Portugal is the only location that qualifies for this type of funding. Priority 4 of the Portuguese Operational Programme specifically aims to better structural networks and equipment in the autonomous region of the Azores (1.5% of funding), more precisely aiming

to improve maritime transport efficiency and safety levels as well as environmental protection by promoting renewable energy production (mini-hydroelectric plants and wind energy).

The European Maritime and Fisheries Fund (EMFF) promotes the development of fisheries and maritime activities. It also aims to safeguard rural coastal communities, promote their economies and jobs creation, and provides financial support to implement the social dimension of the Common Fisheries Policy. The Fund will provide European Member States with 6.5 billion Euro from 2014-2020; the Netherlands will receive over 130 million Euro during that period. Close to 40% of these subsidies are set aside to support the Dutch fishing fleet, specifically on innovation and technical/structural development to support the economic performance of the fleet. The Dutch program aims for a dual approach of simultaneously targeting an increase in sustainability and competitiveness of the sector. The Portuguese Operation Programme (507 million Euro) target towards improving the marketing, diversification and valorisation of seafood products grants compensation for additional costs for the Azores, which has doubled in comparison to the 2007-2013 funding period (EC, 2014c). This example makes clear that the local implementation of the EMFF can introduce sustainable techniques) whilst also increasing pressures on biodiversity (by supporting drivers).

6.2.1 Environmental safeguards in sectoral funding

Similarly to the environmental safeguards presented in the sectoral policy analysis above, examples of good practices when it comes to sectoral funding were identified in some of the case studies.

At local level in the Lough Erne case study, several conditions on agricultural subsidies are in place to reduce the impact of agriculture on water quality. These include verifiable standards for cross compliance, requirements of the Northern Irish Nitrates Action Programme and Phosphorus Regulations, and agri-environmental schemes such as the Environmental Farming Scheme in Northern Ireland and the Green Low-Carbon Agri-Environment Scheme in the Republic of Ireland. There are also voluntary agreements in place that aim to, amongst other things, reduce nutrient loading from agriculture, such as the Origin Green Programme in the Republic of Ireland, which is a voluntary programme to measure sustainability throughout the food and drink supply chain. In terms of nutrient management, it includes additional requirements for manure storage. In Northern Ireland, an agreement is in place with the animal feed industry to reduce its phosphorus content, and therefore potentially reduce phosphorus transport from agriculture to waterbodies. A combination of these measures, along with a rise in fertiliser price, is thought to be responsible for a decrease in phosphorus inputs to agriculture between 2006 and 2013 (Kleinman et al., 2015). The introduction of the Phosphorus Regulations in 2006 and improvements in domestic wastewater treatment are thought to be responsible for a decline in soluble reactive phosphorus concentrations in Northern Irish rivers between 2005 and 2012 (DAERA, 2018). Both parameters have since increased, the reasons for which are unclear.

7 Key conclusions and the way ahead

While it is difficult to compare legislative efforts across case studies, due to different administrative formats, funding processes and scale (i.e., local, regional, national, transboundary), it can be deduced that, though complex in nature, a comprehensive framework for addressing pressures is present for each of the local level AQUACROSS case studies.

Our results establish that in theory sufficient policy instruments are in place to safeguard aquatic biodiversity across Europe on the local level. However, the Mid-Term Review of the Biodiversity Strategy (EC, 2015) has concluded that either the opposite is true and that the environmental policy framework is not strong enough, or that issues arise on another level. It is likely that implementation of environmental policy instruments could be strengthened and better monitored. Our analysis has shown that there is continued regulatory and economic support to economic growth. While sustainable development is a stated objective, economic development is still at the core of the political agenda across case studies, with little attention given to environmental mainstreaming. Economic growth is essential to society by supporting livelihoods particularly on the local level, however, so is aquatic biodiversity through the provision of ecosystem services. This report has taken a closer look at five crosscutting pressures and related drivers in the eight AQUACROSS case studies. We find that policy support has promoted the four identified major drivers: agriculture, fisheries, tourism and renewable energy. Such support contributes to the intensification of pressures on aquatic biodiversity.

The pressure of species extraction, which is driven primarily by fisheries, is a perfect example of a pressure that is highly dependent on local socio-economies across Europe. As stated previously, the number of fishermen across the EU are not as significant as employment provided by sectors such as agriculture. Nevertheless, in some coastal regions, commercial fisheries, and the local ancillary sectors that develop around them, have historically represented the main source of local income and continue to do so today, with locations where 50% of employment is provided by commercial fisheries (EC, 2016). Hence, locally implemented policies based on the Common Fisheries policies, which aim to reduce fishing pressures by regulating and limiting fish catches, will primarily impact these regions, such as the regions represented by the Aveiro and Azores case studies. Nevertheless, these locations are paradoxically extremely dependent on healthy fish stocks, and thus the protection of biodiversity in the coastal and marine realm, as a decline in their health will consequently limit the availability of resources and eventually human wellbeing.

Encouraged by the EU Blue Growth Strategy, EU Member States have included the Blue Growth concept into the national maritime policy, such as in the Portuguese National Ocean Strategy and the Dutch North Sea 2050 Spatial Agenda. Even though these Blue Growth plans include the concept of sustainability regarding fish stock management and fish catches, the primary

focus of the plans lies on economic growth, in particular for the coastal regions. Local biodiversity policies (based on the Birds and Habitats Directive and MSFD) aim to protect biodiversity mainly through a spatial reduction of pressures in protected areas (e.g., in the Dutch part of the North Sea of the North Sea case study, and the Faial-Pico Channel in the Azores case study). Nevertheless, as long as the focus of local development policies is on maintaining or increasing fish catches instead of increasing the added-value of fish catches or promoting other economic activities, such as in parts of the Aveiro case study, the success of local conservation measures will be limited and biodiversity will not recover (APA, 2016). The balance between environmental conservation and economic growth will be a challenge for many coastal towns, as socio-economic prosperity and human wellbeing will depend on its success.

The agricultural sector has had extensive negative effects on aquatic biodiversity in the freshwater and coastal realms of Europe by promoting an increase in nutrient pollution, as well as water abstraction and morphological alterations to aquatic habitats. The pressures and drivers are known and environmental policies are in place for the Lough Erne, Sweden, Andalusia and Aveiro case studies. Yet, the agricultural sector is still promoted by European funding instruments and national and local sectoral policies. In addition, enforcement of environmental safeguards is poor as exemplified by frequent breaches to the Nitrates Directive in Northern Ireland, for example. Our local-level analysis suggests that meeting aquatic biodiversity goals will require local implementation of the CAP to focus to far greater extent on environmental goals.

Renewable energy is celebrated across Europe as an environmentally sustainable and less invasive approach to phasing out more harmful energy sources. While it is true that renewable energy generation can have less impact on the environment than traditional fossil fuels, they can only be environmentally sustainable if the effects to biodiversity are considered in all phases of implementation and operation. Our local-level analysis shows that offshore windfarms and hydropower plants can cause detrimental changes to aquatic habitats in both the freshwater and marine realm, and cause harmful effects on the connectivity of river systems (as shown in the Dutch North Sea and Danube case studies). The issue is that renewable energy is managed as an environmentally-friendly solution, while it is rather an operative shift in structure and infrastructure that may have positive effects on the environment, but may also cause damages. The same goals for energy production and sectoral growth remain, so the connected pressures will continue to increase.

Europe's tourism sector is becoming increasingly important and seen as a future source of economic growth and employment security (EC, 2010b). Already today, 10% of Europe's GDP originates from tourism, and EU and local level polices aim to increase this number (Juul, 2015). At the local level, policies often support an employment shift from historically dominant employment sectors, such as fisheries and agriculture, towards tourism. In the Azores case study, fishermen are supported by a local policy to transform their fishing boats into recreational vessels, for example for recreational sports fishing activities. In Andalusia, policies linked to biodiversity protection aim to promote nature tourism in protected areas, consequentially using local biodiversity as a tourist attraction. In Lough Erne, an increase of

visitors and tourism numbers is strongly supported by local policy. In most policies supporting tourism, sustainability is mentioned as a crucial component. Nevertheless, this is seldom supported by actual definitions of how sustainability should be ensured. Overall, a shift in employment from more traditional sectors, such as commercial fisheries or agriculture might seem to reduce pressures on aquatic biodiversity at first; nevertheless, new arising pressures from tourism should be accounted for and considered when supporting tourism growth through legislation. An ambiguously regulated promotion of tourism will cause an increase in constructions for tourism housing and infrastructure, in addition to a likely pollution resulting from increased household wastewaters (such as in the Swedish case study) and plastic consumption, as well as potentially the transportation of IAS.

The AQUACROSS case studies provide some evidence that the lack of environmental mainstreaming into sectoral policies at the local level could be addressed by applying an ecosystem-based management approach. Ecosystem-based management can be used as an integrative policy tool that aims to identify and understand how society and the environment interact, based on which innovative management responses can be developed. Hence, it can support aquatic biodiversity protection, while maintaining sustainable economic development.

Our findings reveal that the continued support for economic growth across all AQUACROSS case studies can conflict with environmental policy goals. Environmental policies in place are comprehensive on a formal level, but do not achieve their ambitious targets in practice. Our analysis suggests that local policy makers promote economic growth without sufficient environmental safeguards. Many of the drivers found in local areas are linked to emerging economic sectors that are key for local development: agriculture, fisheries, renewable energy or tourism. While these activities are key drivers of the increasing pressures on aquatic biodiversity in Europe, they are directly and indirectly supported by local regulations and European funds. Local policy frameworks need to be restructured to simultaneously aim for biodiversity protection and sustainable economic welfare. Ecosystem-based management is proposed as a policy tool to achieve environmental mainstreaming in local policy frameworks that manage aquatic ecosystems.

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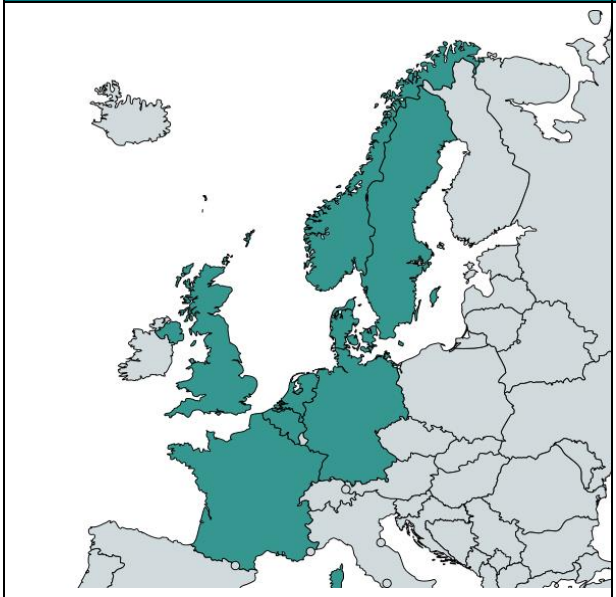
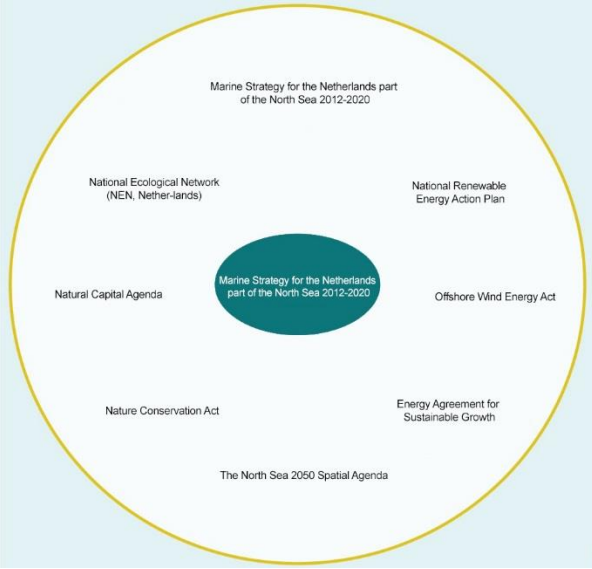
Annex

Case Study 1: Trade-offs in ecosystem-based management in the North Sea aimed at achieving Biodiversity Strategy targets

Member States with jurisdiction	Policies affecting aquatic biodiversity
	

Overview

Semi-enclosed on the continental shelf of north-west Europe, bounded by the coastlines of nine countries and by imaginary lines to the western approaches of the Channel and the northern Atlantic, the North Sea is a significant body of water to the EU. With a total catchment area of 850.000 km2, the North Sea is the setting of numerous economic activities (e.g., fishing, wind power production, oil production, aquaculture, transport, tourism) but is also composed of multiple types of habitats forming a rich and complex biodiversity. This aquatic biodiversity provides the basis of a water-based economy as it provides sources of food, income and job opportunities. The shallowness of the North Sea has been beneficial to fisheries of adjacent Member States for many centuries. However, through anthropogenic threats, such as extraction of species, pollution and morphological changes, biodiversity in the North Sea is at risk, and the landings and stocks of species in focus of fisheries in the area have declined.

The extraction of species in particular has led to multiple impacts, including species mortality, organic input from discarded catch, and physical damage of habitats through bottom trawling. Other pressures include habitat destruction through kelp harvesting, eutrophication through aquaculture and agriculture, water contamination and the introduction of invasive alien species through shipping and offshore activities such as wind energy. The development of offshore wind energy has led to a number of emerging threat in the North Sea, including physical changes to the seabed, underwater noise and electromagnetic changes.

What is threatening aquatic Biodiversity in the North Sea?

The implementation of **offshore wind farms** has a profound effect on the makeup of the sea floor. In addition, impulsive noise in the process of foundation construction as well as cable laying can have temporary or permanent damages on aquatic species. Currently, over 40% of all fish stocks in the North Sea are overfished, making evident the need for sustainable **fisheries management**. In 2017, 71% of all European offshore wind capacity stemmed from the North Sea, with trends rising. This has a significant impact on the makeup of marine habitat, with 20% of current blue mussel stock moving to wind farm structures, which could affect phytoplankton levels and invite invasive alien species.

Trends in the impacts of threats on aquatic biodiversity

- The proportion of large demersal fish has recovered to around 22% in 2008. This is an improvement, but still below target value
- Greater North Sea MPA coverage is the highest in Europe (nearly 18%)

What is driving biodiversity loss in the North Sea?		**Trend**
▸ *Fisheries*	The European Union (EU) fishing industry has 97,000 fishing vessels and 260,000 fishermen. The UK has the largest fishing fleet, in terms of number and capacity, and the most fishermen. Denmark, however, has the largest fleet in terms of catch. Norway, the UK, and the Netherlands follow. All of these MS are highly active in the North Sea. In 2012, the Dutch fleet generated an income of €364 million. This stemmed from €358 million in landings and around €5.9 million in non-fishing income.	↘
▸ *Energy (off-shore wind)*	The Netherlands aim for 16% sustainable energy in 2023. As of 2015, the existing offshore wind farms and those under construction have a capacity of approximately 1,000 MW. Thus, offshore wind energy in the Netherlands is expanding significantly, with a plan towards 4500 MW offshore windpower foreseen until 2019 (700MW/year). This means that by 2023, wind farms will generate over 3% of total energy used in the Netherlands. The Renewable Energy Grant Scheme provides grants to producers and the government also designates suitable sites. The funding scheme offers a 40% cost reduction per MWh until 2024.	↗

Table i: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers		Threats potentially tackled						Key features	Link to EU policy
	Energy	Fisheries	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Marine Strategy for the Netherlands part of the North Sea 2012-2020	X	X	✔	✔		✔	✔	✔	Management plans for Natura 2000 sites to comprise fishing restrictions, regulating the extraction of species from fishing pressures within those areas.	MSFD
									Outside protected areas, status improvement will depend mainly on the ongoing sustainable exploitation of fisheries within the framework of revision of the CFP (2013-2022).	
									Part 2 of the Strategy is the Monitoring Programme and Part 3 of the Strategy is the Programme of Measures. Measures include an experience to launch pulse fishing in 2014 and to implement sustainability certificates for seafood.	
Integrated Management Plan for the North Sea (IBM) (Netherlands) 2015	X	X		✔			✔		Enhance the economic importance of the North Sea and develop the international ecological and landscape features.	WFD, HBD, MSFD
									By developing and harmonising sustainable spatial-economic activities in the North Sea, taking into account the ecological and landscape features of the North Sea", into a management strategy. Measures for management strategies include the defining of usage zones (e.g., shipping routes, military exercise zones, areas with special ecological features), a permit tracking system and disadvantage compensation.	
National Ecological Network (NEN, Nether-lands	X	X	✔	✔	✔	✔	✔	✔	The Government's target is to realise all 728,500 hectares of the network by 2018. This is about 20% of the total land area of the Netherlands.	HBD
									The network will also comprise over six million hectares of waterscape (lakes, rivers, estuaries and the Dutch parts of the North Sea and Wadden Sea).	
Natural Capital Agenda		X	✔	✔	✔		✔	✔	By 2020, both the aquaculture chain and the wild-caught fish chain will meet international sustainability criteria for stock management and biodiversity.	BD2020, HBD, CFP, MSFD, CAP
									over-fishing within EU waters will have been halted as a condition for restoring fish populations and seabed life and the quality of the marine environment will be improved;	
									International Marine Protected Areas will have been introduced to protect biodiversity and over-fishing and pollution will be prevented and tackled where possible.	
Nature Conservation Act	X	X	✔	✔	✔	✔	✔	✔	Regulates the use of nature areas, wild animals and plants in the Netherlands If businesses want to carry out work in Dutch conservation areas, in some cases they need dispensation or a permit with regard to the activities that may harm protected species.	BHD

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

Table ii: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity in the North Sea

Sectoral Policies	Drivers		Key Threats						Key features	Link to EU policy
	Energy	Fisheries	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
The North Sea 2050 Spatial Agenda	Y	Y		✔			✔		Aims to identify the best spatial use of the North Sea until 2050, resulting from consultation between parties from nature, fishing, mariculture, shipping, energy, tourism and recreation. Thus, the agenda indirectly supports drivers to biodiversity loss, but takes into account the effects of economic growth on the environment. However, long-term economic growth is the main focus.	EU Blue Growth Strategy, CFP
									The Spatial Agenda specifically looks at the opportunities presented by the sea, dovetailing with the 'Blue Growth' strategy. In addition, it examines the opportunities and problems of multiple use of the sea.	
									The Spatial Agenda calls for long-term strategy for energy transition for the North Sea to unite economic growth with the challenge of space and other activities (leisure, shipping, fishing)	
Energy Agreement for Sustainable Growth	X						✔		To commit to pursuing a 16% renewable share of energy consumption by 2023. It has been agreed with the relevant stakeholders that 4,450 MW of offshore wind capacity will be operational by 2023. That implies that, from 2015, subsidies must be made available for a total of 3,450 MW of capacity, in addition to the wind farms already in existence and currently being prepared.	EU Renewable Energy Directive
National Renewable Energy Action Plan	X						✔		Describes how the Netherlands intends to achieve the Renewable Energy Directive target of 14% renewable energy in 2020, linked to the Energy Agreement for Sustainable Growth.	EU Renewable Energy Directive
									The intention is to increase the number of wind farms and thus enable related pressures to grow as well.	
Offshore Wind Energy Act	X						✔		Aims to restructure authority for spatial planning arrangements and environmental assessment from private to public. It makes the government responsible for choosing a location for the proposed plant, and assure that construction and operation of the plant is aligned with all governmental institutions and that it will receive grid connection.	EU Renewable Energy Directive

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 2: Analysis of transboundary water ecosystems and green/blue infrastructures in the Intercontinental Biosphere Reserve of the Mediterranean Andalusia (Spain) – Morocco

Member States with jurisdiction	Policies affecting aquatic biodiversity
	

Overview

The Intercontinental Biosphere Reserve of the Mediterranean is located in the Western side of the Mediterranean basin shared by Spain and Morocco. The reserve spans two continents (Europe and Africa), passing through the marine area of the Strait of Gibraltar and covering an extension of one million hectares that includes river basins, coastal and marine waters. The IBRM includes some of the most symbolic natural spaces of the Spanish provinces of Cádiz and Málaga (Andalusia), as well as those in four provinces of northern Morocco: Tanger, Tétouan, Larache and Chefchaouen. The area comprises various Eastern Mediterranean ecosystem types, which provide a diverse range of services and high species richness, which are of great importance for the conservation of the world's biodiversity. The reserve contains a high diversity of species on both shores due to the fact that it is a migration route between the African and European continents. This area is characterized by 40 species of mammals, 117 species of birds, and shows high richness of reptile species (around 50 % of amphibians in the Morocco country are located in the northern part). This reserve is also of exceptional interest for having the best representation and diversity of the Mediterranean vegetation (Junta de Andalucía, 2006). Even though both sides of the IBRM share similar ecological characteristics, the human activities have shaped the landscape differently. From one side, almost 70% of the area is protected in the Spanish section of the IBRM, while in Morocco only 30% of the Reserve is (Vázquez and Díaz, 2008).

What is threatening aquatic biodiversity in Andalusia (Spain) – Morocco

This template addresses the threat of hydro-morphological alterations and water abstraction, which is a concern due to current and expected future trends in land use change and increased water demand associated with a variety of human activities, especially under the context of climate change. The progressive disappearance of the traditional **agricultural** uses has meant in many cases a loss of habitat for some of the species included in the existent conservation plan; **livestock** are also responsible for the degradation of the coastal habitats. Strong **urbanisation** in the coastal areas has led to the severe degradation or even the total habitat loss of the natural coastal ecosystems. The **environmental**

management infrastructures (dams, culverts, water distribution channels, etc.) are responsible for the alteration of the morphology of the river channel and the characteristics of the habitat, causing the loss of the Mediterranean regime. The effects derived from the impact of **constructions** of equipment for civil use on the coast (roads, lighthouses, roads, picnic areas, etc.) and other uses (land subdivisions, creation of garbage dumps and legal or illegal dumps, exploitation of quarries, extraction or spillage of aggregates, etc.) are also especially serious since they may involve the direct elimination of populations or habitats of threatened species, especially those that grow near by the communication routes.

Trends in the impacts of threats on aquatic biodiversity

- The riparian areas (both on freshwater and wetlands) have been taken by agriculture uses and a small section of the channels has also been modified. These alterations of the channel have affected the role in the life cycles of the species as they provide shelter, feeding and reproduction areas, avoid soil erosion, reduce the diffuse pollution from agriculture sources, increase the connectivity of the channel with the riverbanks and link the terrestrial environment with the aquatic one.
- Livestock raising has degraded habitat through trampling and eating of herbs that might occur in populations located near traditional grazing areas, mainly hillsides and non-urbanized coastal dunes.
- Urbanisation has led to the decline of many species, the reduction of the area of typical plants from coastal communities, the isolation of the threatened populations without possibility of expansion due to the urbanized areas in the surrounding. Despite the increasing trend during the last decades, in Morocco the coastal urbanization is less severe.
- Dams, culverts, water distribution channels etc. have caused changes in the river regime, which deeply affect several aspects of the biology of fluvial species, such as seasonal migrations and reproductive, population dynamics, spatial distribution and even phenology.
- Impacts to connectivity, both longitudinally, transversally and with the aquifer can impact the genetic variability of the populations to be isolated by this type of obstacles, being a problem of the first magnitude for the conservation of the species of the aquatic environment.

What is driving biodiversity loss in the Andalusia (Spain) – Morocco?		Trend
Agriculture (& livestock)	Spain: In 2015, 4.22billion m^3 was distributed to agricultural holdings in Andalucia (30% of total amount of water distributed in Spain that year) (INE, 2015). Malaga and Cadiz add 7.9% and 5.0% of agricultural input for Andalusia in 2016 (Junta de Andalucia, 2018). Morocco: 20 billion m^3 of waster consumed by Agriculture at national level (80% surface water, 20% groundwater) (Ministère de l'Agriculture, de la Pêche Maritime, du Développement Rural et de Euax et Forêts, 2017). Value added from agricultural in 2016 was 12%. Average GDP from agriculture (2008-2016) €9.21 billion; +47% over the average from the 2000-2008 period. Agriculture account for 39.3% of employment at national level; 74.5% in rural areas.	↗
Urban areas	Increase in urban area, Spain: 1998-2009 (1956-2009): Cadiz 8% (262%) and Malaga 15% (584%) (Junta de Andalucía, 2015). Morocco: over the last decades, urban development in Morocco multiplied by 3.5 (Robles, 2010).	↗

	Population: Spain; increase in 37% between 1975-2015 in IBRM, 45% in the whole AoI of the IBRM (in particular, Mala, Marvella, Algeciras. Morocco; increase of 53% for the same period, and 90% in the whole AoI. (Barbosa et al. 2017)	
Tourism	New highway (Saida -Tangiers, 510km) in Morocco expected to improve road connectivity and increase accessibility to over 200km of beaches, coves and resorts (Robles, 2010). Tourism strategies for both Morocco and Andalusia promote/envision the growth of tourism activity as an integral part of the socioeconomic development of local populations in the IBRM.	↗
Fishing	The evolution of the capacity of the Andalusian fishing fleet in the last nine years (2006-2015) shows a reduction of gross tonnage GT units) of 41.2%, almost twelve percentage points higher than the national average (-29%). While the average tonnage and the average power of the Andalusian fleet have been reduced by 20% and 10.8% respectively to stand at 24.42 GT and 104.44 CV; the national average per boat has grown 0.6% in GT and 3.3% in CV. The Andalusian fishing sector has reduced in nine years not only the capacity but the size of its boats, so the average length of the Andalusian fleet went from 12.13 meters in 2006 to 11.98 in 2015 (Junta de Andalucia, 2015). In the coast of the Alboran Sea, Morocco, fishing is one of the main socio-economic activities. Production in 2009 was 39,000 tons/yr with a value at around 33 million € (PRC, 2011). Average growth of 5% per year between 2001 and 2008. The Halieutis Plan (national Fisheries plan established in 2009) has the aim of doubling the value of fisheries to the Moroccan economy by 2020.	↘ Spain ↗ Morocco
Aquaculture	Spain: GDP marine aquaculture (2009) Estrecho and Alborán MD: 9.707,000 €; South Atlantic MD: 7,344,000 € (Spain: 138,624,000 €). Aquaculture activities have expanded significantly recently (MAGRAMA, 2012a) Morocco: Aquaculture (Alboran Sea): two active aquaculture sites (in the Bay of M'Diq). Areas with great potential already identified (Nador lagoon (March Chica), berries Jebha, Ras Kebdana and Cala Iris (Al Hoceima), open sea area of M'diq). UNEP/MAP (2015).	↗
Transport (shipping)	The Alborán Sea includes 26 important harbours (15 Spain; 8 Morocco; 3 Algeria). It is the 2nd busiest sea route with over 25% of global maritime traffic crossed through the Strait of Gibraltar. (UNEP/MAP, 2015). Increasing number of container ships are docking in ports in Algeciras and Malaga (Robles, 2010; PRC, 2011). Algeciras Bay Port was the busiest Mediterranean port in 2015: 103.7 million tonne of total cargo throughput and over 4.7 million TEUs (twenty-foot equivalent unit) (EUROSTAT, 2017). The port of Tangier is the largest in Africa and Mediterranean in terms of capacity : 3 million containers (PRC, 2011) This will triple to 9 million containers with the upgrade of the port, to be completed in 2019 (TMPA, undated). It is expected that the port will become one of the most relevant trans-shipments hubs in the Atlantic and Mediterranean.	↗

Table iii: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers						Threats potentially tackled						Key features	Link to EU policy
	Agriculture	Urban Areas	Tourism	Fishing	Aquaculture	Transport	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Plan for the Recovery and Planning of Network of Cattle and Green Corridor Routes	X		X						✔		✔		This plan covers the entire autonomous region of Andalusia, with the aim of preserving cultural heritage, supporting livestock raising activities, ensuring ecosystem connectivity for purposes of biodiversity conservation. Malaga has a total of 785.13km and Cadiz has 1,258.36km (as of 2014). Funding sources include EARFD and ERDF	BD; HD; Green Infrastructure
Andalusian Strategy for Integrated Management of Biodiversity	X	X	X	X	X	X	✔	✔	✔	✔	✔	✔	3rd objective (of 8 total): promoting sustainable development model that consolidates the value of biodiversity and reinforces its role as a source of good and services (natural capital)	BD, HD, Green Infrastructure
Master Plan for Ecological Connectivity in Andalusia	X	X	X										This is the central coordination instrument for ecological connectivity in Andalusia, contributing to the coherence of the Natura 2000 network.	BD, HD
National Plan for Watershed Management, Morocco	X								✔		✔		Adopted in 1996. Main objective is to define priorities in terms of management (between the basins and the interior of the basins) and the institutional and financial arrangements necessary for the realization of these goals over a 20-year horizon	N/A (WFD)
National Strategy and Action plan for Biodiversity of Morocco 2016-2020	X	Y	X	X	X	Y	✔	✔	✔	✔	✔	✔	Various aspects of protection and development of national biodiversity, among them the protection, preservation and rehabilitation and the optimization of the exploitation of biodiversity.	N/A (EU BDS 2020)
IBRM Action Plan 2011-2015	X	X	X	X		Y			✔		✔		Defines the strategic lines for the optimal implementation of the Mediterranean Intercontinental Biosphere Reserve Andalusia (Spain) -Morocco. Coordination and management committees have been set up on both side of the IBRM.	INTEREGG
Moroccan Master Plan for Protected Areas h2020			X	X					✔		✔		Under this plan, Morocco set an ambitious target that aims to reclassify the existent areas and increase the amount of protected areas.	N/A (HBD)

													Currently Morocco has 34% of the terrestrial territory protected and 1% of the marine area.	
Marine Strategy, Estrecho and Alborán seas			Y	X	X	X	✔	✔		✔	✔	✔	**Objectives include ensuring the conservation and restoration of marine biodiversity – In terms of habitat and ecosystems; reduce the intensity and area of influence of the anthropogenic pressures over the benthic habitats, with special attention to the biogenic habitats and /or protected areas that are hotspots of biodiversity and are key to ensure services and function of the marine environment: marine phanerogams, infralittoral and circalittoral rock habitats, maërl bottoms, among others); and recover the species and restoration of the degraded habitats**	**MSFD**
RBMPs for Guadalete-Barbate & Mediterranean Basins	X	X	X		X	X	✔	✔	✔	✔	✔		management framework for water uses, the RBMP include measures to improve the longitudinal continuity, the structure of the riparian areas and river banks and the structure of the coastal riparian areas, contributing to the reduction of biodiverity loss.	WFD

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

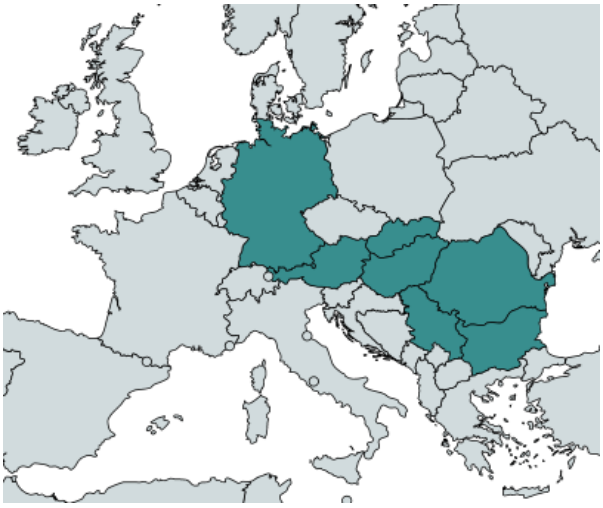
Table iv: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity in the IBRM

Sectoral Policies	Drivers						Key Threats						Key features	Link to EU policy
	Agriculture	Urban Areas	Tourism	Fishing	Aquaculture	Transport	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Green Morocco Plan	X						✔		✔		✔		The Plan for agricultural development to 2020, with 2 fundamental pillars (1) Development of modern and competitive agriculture; (2) Support to smallholder agriculture, and the conversion of cereal crops to higher-value alternatives and as well as value-added processing. Key targets include: (1) Modernisation projects aim to reach 400,000 farmers, generate 150 billion dirhams of investments (€13.45 billion) around 900 projects (2) Between 600,000 and 800,000 farmers are to be affected by this strategy. The planned investments are estimated between 15 billion dirhams (€1.35 billion). 3 million rural people should see their living conditions improved.	N/A (CAP)
Rural Development Plan for Andalusia	X	X	X	X	X		✔		✔		✔		The total budget for the 2014-2020 period is €2,400,000,000 (79.2% EU funding; remainder finances (70:30) by the Regional Government and the Ministry of Agriculture and Environment. In this region (classified as in transition), EARDF contribution is 75%. The remaining 25% from Spain (70% Andalusia Region and 30% Ministry of Environment and Agriculture)	CAP, Regulation 1305/2013
General Plan for Sustainable Tourism of Andalusia		Y	X				✔		✔		✔	✔	Promotion of national natural resources and nature tourism (including specific mentions to the Andalusian Protected Areas Network as an important asset for the region, in particular in context of the objective of reducing dependence of beach tourism. €400.2 Million 30 programmes, 25 of which include European Fund contributions	Regulation (EU) n° 1303/2013,
Sustainable Tourism Strategy of Morocco H2020		Y	Y				✔		✔		✔	✔	One of the main challenges identified by the "Vision 2020" is the development of a competitive, diversified, but also balanced tourism offer, capable of meeting the demand, in different fields such as seaside, cultural, nature or even sport and well-being. The strategy aims to double the capacity of tourist accommodation with the construction of 200,000 new beds; Double the number of tourists; and triple the number of domestic tourism.	N/A

Operational Programme for EMFF (PO FEMP)	Y	Y		✔	✔		✔	✔	✔	Total EMFF funding for 2014-2020 period: €1.15 Billion. Distribution of resources by thematic objective: a) 50.8% Promote the competitiveness of SMEs and the fisheries and aquaculture sector; b) Favour the transition to a low carbon economy in all sectors 1.8%; c) Conserve and protect the environment and promote the effectiveness of resources 31.2%; d) Promote quality and sustainable employment and support labour mobility. 11.1% (the remaining 5.2% is reserved for technical assistance)	EMFF
National Fisher Plan of Morocco (Halieutis)	Y	Y	Y	✔	✔		✔	✔	✔	This instrument aims to increase the value added by the fisheries industry to the Moroccan economy, with the aim of doubling the value by 2020.	N/A

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 3: Danube River Basin – harmonising inland, coastal and marine ecosystem management to achieve aquatic biodiversity targets

Member States with jurisdiction	Policies affecting the Danube
	

Overview

The Danube river basin covers more than 800 000 km² and 10% of continental Europe. Over 80 million people live in the basin, in territories belonging to 19 different countries. Important uses of the Danube are linked to drinking water, energy production, agriculture and transport. According to the second basin wide river basin management plan for the Danube (ICPDR 2015a), the main pressures are pollution and hydromorphological alterations. Pollution pressures include pollution by organic substances, nutrients, and hazardous substances. Important hydro-morphological pressures include both hydrological pressures (water abstraction, impoundments, hydropeaking) and morphological changes (channelization, reduction of lateral and longitudinal connectivity). The AQUACROSS Danube case study is centred around hydro-morphological pressures on catchment and regional scale, with a focus on longitudinal and lateral connectivity. Longitudinal river connectivity is in particular considered in relation to hydropower plants, whereas lateral connectivity is analysed regarding the disconnection of floodplains along the navigable stretch of the Danube and within the Danube Delta.

What is threatening aquatic Biodiversity in the Danube?

The key driving forces causing eventual longitudinal continuity interruptions in the DRBD are mainly **hydropower generation** (50%), **flood protection** (18%), and **water supply** (10%). In many cases barriers are not linked to a single purpose due to their multifunctional characteristics (e.g., hydropower use and **navigation**; hydropower use and flood protection). 1,030 barriers are located in DRBD rivers with catchment areas >4,000 km² (ICPDR 2015a). Regarding the loss of floodplain areas, it is in particular caused due to the expansion of agricultural uses and the disconnection from water bodies due to river engineering works concerning mainly flood control, navigation and hydropower generation (ICPDR 2015a).

Trends in the impacts of threats on aquatic biodiversity

- 56% of the Danube River have been designated as heavily modified; Good ecological status cannot be achieved in these stretches due to physical alterations.

- Only 22% (5,494 km) of the length of tributaries are of good ecological status/potential
- 33% of the total number of water bodies in the Danube river basin district are significantly altered by continuity interruptions un-passable for fish species (ICPDR 2015a)
- Compared with the 19th Century, less than 19% of the former floodplain area (7,845 km2 out of a once 41,605 km2) remain in the entire DRB (ICPDR 2015a)

What is driving biodiversity loss in the Danube?		Trend
Energy (hydropower)	In most Danube countries (except DE, HU and MD), hydropower contributes more than 45% of renewable energy production. Electricity production from hydropower will increase in most countries, but the share will not.	→
Agriculture	The present level of the total nutrient load in the Danube River system is considerably higher than in the 1960s, but lower than in the late 1980s. The decrease from the 1990s to the present situation is due to the political as well as economic changes in the middle and lower DRB resulting in (i) the closure of nutrient discharging industries, (ii) a significant decrease of the application of mineral fertilisers and (iii) the closure of large animal farms (agricultural point sources) (ICPDR 2015a).	↘
Flood protection	15 future infrastructure projects related to flood protection have been reported for the second Danube river basin management plan (ICPDR 2015a). At the same time, natural water retention measures, which can have positive effects on biodiversity targets, are strongly encouraged by the Danube Flood Risk Management plan, and planned to be implemented by member states (ICPDR 2015b).	→
Navigation	Ships can navigate 2,411 km, or 87% of the length of the Danube. As "Corridor VII" of the European Union, the Danube connects the Black Sea with the industrial centres of Western Europe and with the Port of Rotterdam. 20 future infrastructure projects related to navigation have been reported for the second DRBMP (ICPDR 2015a).	↗

Table v: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers				Threats potentially tackled					Key features	Link to EU policy
	Energy	Navigation	Flood protection	Agriculture	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology		
Austrian Biodiversity Strategy 2020+	X	X	X	X	✔	✔	✔	✔	✔	Measures for revitalising, modernising and increasing efficiency of hydropower plants while simultaneously improving ecological conditions	BD2020,BHD, WFD
										Increasing ecological continuity on important transport ways	
Danube River Basin District Management Plan	X	X	X	X	✔		✔	✔	✔	Non EU Member States committed themselves to implement the WFD within the frame of the Danube River Protection Convention (DRPC)	WFD (+Floods Directive; Nitrates Directive; Urban Waste Water Treatment Directive, CAP; etc.)
										The DRPC represents the legal, as well as political, framework for co-operation and trans-boundary water management in the DRB.	
Austrian National Water Management Plan 2015	X	X	X	X	✔	✔	✔	✔	✔	Measures targeting water abstractions include measures to increase residual amounts of water in water bodies. This measure is linked to hydropower production and necessary for the passability of fish.	WFD (+Floods Directive; Nitrates Directive; Urban Waste Water Treatment Directive, CAP; etc.)
										Morphological modifications linked to flood protection are targeted through the promotion of restoration measures	
										Planned measures include different types of fish passes to overcome migration barriers, as well as measures targeting point and diffuse pollution.	
The Austrian National Park Strategy	X		Y	Y			✔	✔	✔	Reduction of the impacts of hydroelectric power stations and water use, as well as impairment of watercourse structure by construction works in accordance with the EU Water Framework Directive.	WFD, BHD
										Adapt management activities (wildlife management/hunting, forest management, agriculture, alpine farming, etc.) to the protection of natural process and embed them in the management plans in accordance with IUCN guidelines for category II, as well as the position papers and guidelines adopted by national parks Austria	
Environmental Control Act	X	Y	Y	X	✔	✔	✔	✔	✔	Monitoring of environmental changes	Environmental impact assessment (2011/92/EU) Directive
										Publishing results for local and national authorities and the public	
										Environmental Control Report published every three years	

Floodplain strategy for Austria 2020+	X	X	X	X		✔	✔	Plans for prioritising river floodplains for restoration	BD2020 (in particular target 2); WFD; Floods Directive; BHD; Green Infrastructure Strategy
								Focus on connectivity of floodplains and securing flood plain areas	
								Restoration projects (including relocation of dykes)	
Action Programme Nitrate				X	✔			National provisions regulating the dispersal of nitrate containing fertilisers	EU Nitrates Directive
Action programme Danube 2022 of the national Ministry for Transport, Innovation and Technology	Y	X	X	Y			✔	Integrative strategy including objectives and a programme of measures for navigation, ecology and flood protection	EU Programme NAIADES II; EU Strategy for Danube Region; EU Floods Directive; BHD; WFD; Trans-European Transport Network (TEN-T) policy

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

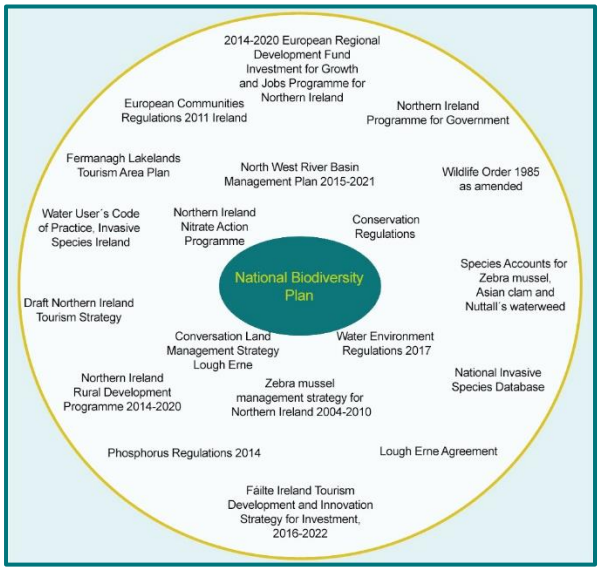
Table vi: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity in the Danube

Local policy instrument	Driver				Key Threats					Key features	Link to EU policy
	Energy	Navigation	Flood protection	Agriculture	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology		
National Renewable Energy Action Plans	X								✔	Overall target: 34% of share of energy generated from renewable sources in gross final energy consumption;	EU Renewable Energy Directive
Green Electricity Act 2012	X								✔	Heating and cooling: 33% of heat consumption met by renewable sources; Electricity: 71% of electricity demand met by electricity generated from renewable energy sources; Transport: 11.5% of energy demand met by renewable energy sources.	
										By 2015, share of electricity had to reach 15%; By 2020, 71% of electricity demand is to be met by renewables	
Federal Energy Efficiency Act	X								✔	Target: the Austrian final energy consumption must not exceed 1.050PJ in 2020	Energy Efficiency Directive 2012/27/EU
										As of 1st January 2015, all energy suppliers (with the exception of very small businesses) must implement demonstrable measures to increase energy efficiency to reach a target of 0.6% annual increase in energy efficiency	
Austrian Water Catalogue: Water conservation – water use	Z								✔	A catalogue of criteria to review hydropower projects regarding energy, ecology and other criteria	
										The catalogue gives decision-making support to see if a hydropower project is economically profitable as well as environmentally feasible	
Austria's Rural Development Programme				Y	✔		✔			Until 2020, 1.1 billion will be made available per year	EU CAP
										71% of budget to support better management of natural resources and encouraging climate friendly farming practices	
Austrian agri-environmental programme				Y	✔					Overall, the programme comprises nineteen agri-environment climate measures, one organic farming measure, two animal welfare measures and one Natura 2000-agriculture measure.	EAFRD
National action plan under the Fairway rehabilitation and maintenance master		X		X					✔	Dredging, river engineering measures, etc. to ensure navigability	Trans-European Transport

plan for the Danube and its navigable tributaries											Network (TEN-T) policy
Overall transport plan for Austria 2012		X		X					✔	Foresees dredging and expansion of ports in order to promote inland navigation.	TEN-T
National Flood Risk Management Plan 2015			Y						✔	The programme of measures includes structural flood protection measures, as well as non-structural measures like flood prediction systems, improvement of water retention, securing areas, sustainable land use, etc.	EU Floods Directive
Hydraulic engineering act (1985)			X						✔	Financing of flood protection measures.	EU Floods Directive

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 4: Management and impact of Invasive Alien Species (IAS) in Lough Erne in Ireland

Member States with jurisdiction	Policies affecting aquatic biodiversity
	

Overview

The two lakes that make up Lough Erne are widened channels of the River Erne and are located in Northern Ireland. The lakes' catchment, however, is transboundary, as the river both upstream and downstream of the lakes runs through the Republic of Ireland. Upper Lough Erne is a shallow lake of 1552 ha and is naturally eutrophic. The Lower Lough Erne is larger (15 303 ha) and deeper (up to 60 m). The primary land use around the lakes is agriculture, of which the majority is livestock, along with some heathland/scrubland/woodland, small areas of forest and small towns. The lakes are a popular destination for tourism and recreation, especially for recreational boating, including through the Shannon-Erne waterway, which links the Rivers Shannon and Erne, and angling. The water levels in the lakes are regulated by several control structures, including hydroelectric dams owned by the Irish Energy Supply Board.

The AQUACROSS Lough Erne case study is focused on invasive alien species, particularly Nuttall's waterweed (*Elodea nutalli*), the zebra mussel (*Dreisenna polymorpha*) and the Asian clam (*Corbicula fluminea*). These species are primarily introduced through recreational boating and fishing, which allow organisms to be transferred between waterbodies on equipment. Nutrient enrichment from livestock farming in the Lough Erne catchment is a further threat to the lake ecosystem and facilitates establishment of Nuttall's waterweed. The presence of invasive species is changing the lake ecology, including triggering a shift from turbid to clear water, a decrease in algal biomass, and outcompeting several native species.

What is threatening aquatic Biodiversity in the Lough Erne?

The main drivers threatening aquatic biodiversity in Lough Erne are **tourism and recreation**, which contribute to the introduction and establishment of invasive alien species, and **agriculture**, which is responsible for the majority of nutrient loading to Lough Erne (76% for soluble phosphorus and 86% for nitrate).

Trends in the impacts of threats on aquatic biodiversity

Both the Upper and Lower Lough Erne are classified as moderate ecological potential; both are designated as heavily modified waterbodies. This classification did not change between the 2009 and 2015 assessments. Within the Lower Lough Erne Local Management Area, 27% of water bodies met good ecological status/potential in 2009. Within the Upper Lough Erne Local Management Area, 23% of waterbodies met good ecological status/potential in 2009. In the equivalent area to the Lower Lough Erne Local Management Area, 40% of waterbodies met good status in 2015. In the equivalent area to the management area for the Upper Lough, 50% of waterbodies met good status. However, there were several changes to the WFD classification system between 2009 and 2015, including changes to monitoring and assessment methods, the number of waterbodies, and the assessment of cross-border waterbodies. Therefore, it is difficult to determine to what extent the reported changes represent an improvement in water quality or they are the consequence of methodological changes. Ecological status throughout the North Western River Basin appears to have similarly improved between 2009 and 2015, from 30% of waterbodies meeting good status in 2009 to 45% in 2015. One of the seven water-dependent Special Areas of Conservation designated under the Habitats Directive within the Upper and Lower Lough Erne Local Management Areas is in favourable condition. One of the three water-dependent Special Protection Areas designated under the Birds Directive is in favourable condition.		
What is driving biodiversity loss in the Lough Erne?		
Tourism and recreation	The tourism sector generated £58.8m in County Fermanagh and supported 3448 jobs in Fermanagh and Omagh in 2013. At Northern Ireland level, several policies and instruments support tourism, although it is not directly subsidised. Air passenger duty (in place in the rest of the UK) was abolished for passengers arriving in NI on long-haul flights and is under review for short-haul flights, in an effort to improve competitiveness of the NI tourism industry. Similarly the current VAT rate of 20% is under review to improve competitiveness of NI in relation to the Republic of Ireland, where VAT is 9%. Funding and financing for tourism businesses is available via several means from Tourism NI and Invest NI. Approximately 25 000 angling licences are sold annually. The number of non-resident licences issued is gradually increasing. In 2014, visitors participating in coarse angling matches in Lough Erne generated £630 000 in 2014. Recreational boating is popular, although there is no comprehensive data on uses and trends in Lough Erne. In 2015, 730 boats entered Lough Erne through the Shannon Erne waterway.	↗
Agriculture	In Fermanagh and Omagh, there are 201 470 ha of rough grazing and grass and 726 ha of cropland. Long-term trends for cattle farming in NI are that dairy cow numbers are increasing while beef cow numbers are decreasing. There was a 21% decrease in beef cows between 2002 and 2016, due to subsidies no longer being linked to livestock numbers. Between 2015 and 2015, both dairy and beef cattle numbers increased, by 2 and 4% respectively. The value of agriculture for wards in the Northern Irish part of the Lough Erne catchment is estimated at €143m/year. The Enniskillen area, located between Upper and Lower Lough Erne, received the largest amount of CAP funding in NI in 2013/2014 – 4060 beneficiaries received £38.9m. In 2015, the beneficiaries in this area received £25m in direct EAGF payments and £3.9m in agri-environmental payments. Across NI, approximately 1.2% of farms operated under an approved derogation from the Nitrates Action Programme and Phosphorus Regulations in 2016.	→

Table vii: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers		Threats potentially tackled					Key features	Link to EU policy
	Agriculture	Tourism	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology		
Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995	Y			✔				Designation of sites of Community Importance, enabling land management agreements, providing for control of potentially damaging operations, protection of listed species	EU Habitats Directive
Environment (Northern Ireland) Order 2002	Y							Designation, protection and management of Areas of Special Scientific Interest, which 'underpin' the network of sites designated as Natura 2000.	EU Habitats Directive
European Communities (Birds and Natural Habitats) Regulations 2011 Ireland				✔		✔		Creates an offence of growing listed non-native plants or allowing the escape of or releasing listed non-native animals, including the zebra mussels, Asian clam and Nuttall's waterweed.	EU Birds and Habitats Directives
Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017	Y		✔		✔		✔	Requires establishment of river basin districts, development of river basin management plans, identify environ-mental objectives and programmes of measures to achieve them, and other provisions of the WFD.	EU Water Framework Directive
National Invasive Species Database		Y				✔		Compile and communicate species distribution data to inform local action	EU regulations on prevention and management of invasive alien species
								Early warning of new invasions to allow rapid response	
								Lists the zebra mussel, Asian clam and Nuttall's waterweed as invasive alien species	
Zebra mussel management strategy for Northern Ireland 2004 – 2010		X				✔		Aims to minimise spread of zebra mussels from Lough Erne to unaffected water bodies	EU regulations on prevention and management of invasive alien species
Wildlife Order (NI) 1985 as amended				✔		✔		Creates offence of growing listed non-native plants or allowing the escape or re-leasing listed non-native animals	EU Birds and Habitats Directives
Ireland's 3rd National Biodiversity Plan 2017-2021	X	Y	✔	✔		✔		Control harmful invasive alien species and reduce the risk of new species spreading	EU Biodiversity Strategy
								Assess the risk of new invasions and rapidly responding, as well as for the continued and enhanced eradication, control and containment of existing IAS	
Water Users' Code of Practice, Invasive Species Ireland		X				✔		Voluntary code of practice for water users to reduce spread of IAS to unaffected waterbodies on equipment	Invasive Species Regulations
								Recommends that users inspect, remove, dispose and report, with specific guidance for different types of uses and equipment	
Species accounts for zebra mussel, Asian clam and Nuttall's waterweed		X				✔		Provides advice on preventing spread of invasive alien species	Invasive Species Regulations

North West River Basin Management Plan 2015-2021	X	Y	✔	✔	✔	✔	✔	Includes actions to implement NI's IAS strategy, research their effects on the aquatic environment and assess impacts of specific species	WFD
								Requires continuation of partnerships for IAS monitoring to understand distribution and spread	
Conservation Land Management Strategy Lough Erne	X	X	✔	✔		✔		Liaise with partners and develop citizen science projects to monitor and record IAS locations	Invasive Species Regulations
								Develop partnerships for surveying, research, mitigation and education around IAS and to promote existing codes of practice and biosecurity measures for water users	
Northern Ireland Nitrate Action Programme given legal effect by Nitrates Action Programme Regulations (Northern Ireland) 2014	X		✔					Applies to all agricultural land in NI and is a component of cross compliance. Aims to improve use of nutrients on farms and therefore improve water quality. Northern Ireland has a derogation for certain farmers, giving them an application limit of 250 kg nitrogen/ha/year, as opposed to 170 kg/ha/yr without a derogation. In 2016, approximately 1.2% of farms in Northern Ireland operated under an approved derogation.	Nitrates Directive, River Basin Management Plan (WFD)
								Includes several measures within the categories of closed spreading periods, land application restrictions, livestock manure nitrogen limits, overall nitrogen fertiliser limits, high phosphorus manures, manure and silage storage, land management and record keeping.	
Phosphorus (Use in Agriculture) Regulations (Northern Ireland) 2014	X		✔					Aims to improve use of nutrients on farms and therefore improve water quality	River Basin Management Plan (WFD)
								Compliance is not required for cross compliance but is required by law.	
								Require that chemical fertilizers containing phosphorus be only applied when soil analysis shows a crop requirement.	
								Gives phosphorus recommendations for grassland and phosphorus availabilities for organic manures.	
Ireland's Nitrates Action Programme, given legal effect by European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014	X		✔					The NAP includes limits on farm stocking rates, fertiliser application rates and timing, minimum manure storage requirements and setback distance from waters. Ireland has a derogation for intensive farmers, giving them an application limit of 250 kg N/ha/year, as opposed to 170 kg N/ha/yr without a derogation.	Nitrates Directive
Ireland Rural Development Programme 2014-2020	X		✔					Aims to manage natural resources sustainably, as well as to improve the competitiveness of agriculture and support rural development. Includes support for the Green Low Carbon Agri-Environment Scheme, which, amongst other things, aims to protect predefined vulnerable watercourses through creation of riparian margins and protection of watercourses from bovines. Applicants are required to have a farm nutrient management plan in place.	Council Regulation 1698/2005 on support for rural development by EAFRD
Northern Ireland Rural Development Programme 2014-2020	X		✔					Aims to manage natural resources sustainably, as well as to improve the competitiveness of agriculture and support rural development. Includes support for the Environmental Farming Scheme, which offers finances measures for environmental improvement, including water quality protection measures such as creation of riparian buffers and stabilisation of watercourses with fencing.	Council Regulation 1698/2005 on support for rural development by EAFRD

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

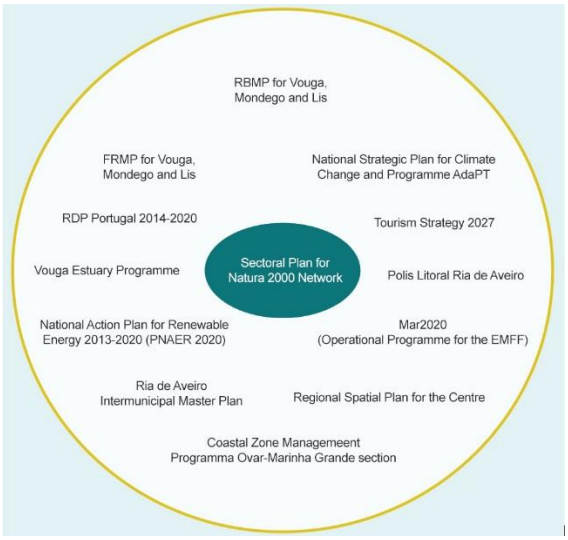
Table viii: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity in the Lough Erne

Sectoral Policies	Drivers		Key Threats					Key features	Link to EU policy
	Agriculture	Tourism	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology		
Common Agricultural Policy	X		✔					Aims to ensure the competitiveness and sustainability of European agriculture	EU CAP
								Provides direct support to farmers if basic rules, including environmental rules, are respected (cross-compliance and greening). Implemented through several regulations, the most relevant of which are described below.	
Common Agricultural Policy Basic Payment and Support Schemes Regulations (Northern Ireland) 2015	X		✔					Make provision for the EU Regulation on direct payments to farmers, which aims to support farm income through basic income support and targeted payments. Implements the EU Regulation and specifies the application in Northern Ireland of those articles for which Member States must make decisions. Defines the minimum farm size for receiving direct payments as three hectares. Defines the allocations for payments to farmers. For the purposes of calculating the greening payment for farmers, the regulations define permanent grasslands in areas to which the Nature Directives apply as environmentally-sensitive permanent grassland. Ecological focus areas are considered as land lying fallow, agro-forestry, short rotation coppice, afforested areas and areas with nitrogen fixing crops, in addition to the requirements of the EU Regulation.	Regulation (EU) 1307/2013 establishing rules for direct payments to farmers under support schemes within the framework of the CAP
Northern Ireland Rural Development Programme 2014-2020	X		✔					Aims to improve the competitiveness of the agriculture industry and to support rural development, as well as manage natural resources sustainably. The £623 million budget is made up of 186.5 million of EU money 186.5 million from the Department of Agriculture, Environment and Rural Affairs, and £250 million from the Northern Ireland Executive for a farm business improvement scheme. The budget is used to support rural development through several schemes, in addition to the agri-environment scheme outlined above. Business Development Groups aim to improve the technical efficiency of farm businesses. The Farm Business Improvement Scheme offers support for investments to improve farm competitiveness and sustainability up to £30 000.	Regulation (EU) 1305/2013 on support for rural development by the EAFRD

2014-2020 European Regional Development Fund Investment for Growth and Jobs Programme for Northern Ireland	Y	X	✔			✔		Total budget for the programme is 522 million euros, of which 313 million is provided by the European Regional Development Fund and 209 million is match funding from a range of public and private sources. The programme aims to improve the economic competitiveness of Northern Ireland. The most relevant priority axis aims to enhance the competitiveness of small and medium sized enterprises through a range of access to finance mechanisms and SME growth initiatives. ERDF funds are used to support Invest NI, the regional business development agency. The agency provides financial assistance to new and established businesses, including the tourism industry. Between 2011 and 2014, it offered £330 560 to tourism sector businesses in Fermanagh, making up approximately 20% of total investment in the sector during this period. The ERDF also supports NI's Tourism Development Scheme, which provides grants for tourism amenities, infrastructure and products.	Regulation (EU) 1301/2013 European Regional Development Fund Regulation
Northern Ireland Programme for Government (tourism relevant sections) (consultation document)		Y				✔		Aims to increase growth of tourism sector, particularly in numbers of international visitors, through a number of measures	Communication (COM/2010/0352 final) Europe, the world's No. 1 tourist destination
Draft Northern Ireland Tourism Strategy		Y				✔		The previous strategy aimed to increase visitor numbers and earnings throughout NI. The effect of the current version is assumed to be the same.	Communication (COM/2010/0352 final) Europe, the world's No. 1 tourist destination
Fáilte Ireland Tourism Development and Innovation Strategy for Investment, 2016-2022		Y				✔		Aims to deliver sustainable growth in the tourism industry and increase jobs, foreign earnings and the economic contribution of tourism.	Communication (COM/2010/0352 final) Europe, the world's No. 1 tourist destination
								Aims to improve access to the outdoors and promote outdoors activity businesses.	
Fermanagh Lakelands Tourism Area Plan		Y				✔		Aims to increase visits by 17% between 2013 and 2020 and to increase spend to £50m by 2020. Emphasises the need to continue with partnerships (e.g., with Waterways Ireland) to enhance water-based recreation.	Communication (COM/2010/0352 final) Europe, the world's No. 1 tourist destination
Lough Erne Agreement	Y	Y				✔		Agreement between the governments of the UK and the Rep. of Ireland that specifies the range within which water levels in Lough Erne must be kept.	

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 5: Improving integrated management of Natura 2000 sites in the Ria de Aveiro Natura 2000 site, from catchment to coast, Portugal

Member States with jurisdiction	Policies affecting CS5
	

Overview

The Ria de Aveiro CS focuses on alterations to hydromorphology (in particular in the transitional water realm and adjacent upstream freshwater realm), as this has been identified by CS stakeholders as a main concern and a priority for management (Dolbeth et al., 2016), as well as possible mitigation measures. Changes in hydro-morphology of the system have been given special attention due to the concern of stakeholders and the complexity of the threat. Stakeholders identify the connection to sea infrastructure and maritime transport, i.e., harbour, port facilities and maritime transport, as a major economic activity. However, the associated dredging activities are recognized as the major cause for the changes in the system hydro-morphology, affecting the lagoon tidal prism, the navigability in smaller channels, promoting shoreline erosion, habitat loss and fragmentation and salt water intrusion (Lillebø et al [Eds], 2015; Dolbeth et al., 2016).

What is threatening aquatic Biodiversity in the Aveiro?

Stakeholders have identified **hydro-morphological alterations** as the key threat to be tackled, given the complexity of the ecological (i.e., over 25 habitat types across fresh, transitional and coastal/marine water realms, threatened to varying degrees by hydro-morphological pressures from various drivers) and socioeconomic (i.e., 11 municipalities with interests in the Aveiro Region, multiple sectors with numerous activities causing alterations) systems.

Trends in the impacts of threats on aquatic biodiversity

- Decrease in seagrass beds: decrease in nursery function and modification of nutrient cycling
- Excess growth of *Ecihhornia crasspies* (Common Water Hyacith) in freshwater channels
- Alterations to system hydrology increase in tidal velocity, water turbidity and channel depth, changes in tidal prism and light penetration;
- Alterations of physicochemical characteristics;
- Decline in intertidal area, mudflats, and salt marshes;
- Increase of saltwater flooding period, surface salt water intrusion, salinization or agricultural areas;
- Impoverishment of sediment bed and modification in sediment dynamics (Dolbeth et al 2015).

- The Ria de Aveiro basin, from catchment to coast includes 74 water bodies according to the WFD. For the purposes of the analysis, of the 14 water bodies considered, 3 have an overall status classification of Good/Very good according to WFD status labels (2009-2015) and the total is expected to rise to 4 for the 2016-2021. One water body will deteriorate to less that good quality, as a result of point and diffuse pollution.
- Of the 11 bodies expected to have a status of less than good for the next reporting period, the extension/derogations under Art. 4 of the WFD are divided as follows: Technical feasibility, 5 water bodies; Disproportionate costs, 3 water bodies; Natural conditions, 2 water bodies.
- Ria de Aveiro transitional water body WB2 is classified as highly modified, as a result physical changes in the channels morphology, navigability and shoreline vegetation. The status of this body is not expected to improve for the 2016-2021 period.

What is driving biodiversity loss in Aveiro?

Agriculture	Smallholder agriculture: 41% decrease in number of Agricultural Holdings 1989-2009. These agricultural holdings have been characteristic of the area for centuries and have served to enhance biodiversity in BVL, thus their reduction is expected to have a negative impact on biodiversity. Further, these holdings require high maintenance, which is been lacking, in order to combat draining issues and the increase of salinity, thus leading to changes in surrounding habitats and to biodiversity loss. Livestock raising: 23% increase in livestock units 1989-1999 followed by decrease of 12% between 1999-2009. 59% of agricultural area is utilised, with 27% irrigated. (Sousa et al 2015 ;PGRH4A, 2016)	↗
Aquaculture	Currently there are a total of 55 aquaculture licenses (52 Ílhavo and 3 in Aveiro), and these activities do not yet constitute a significant pressure. However, a key objective of the MAR2020 is to triple aquaculture activities by 2023, thus contributing to food supply, environmental protection and employment, and implies an upturn in the trend, leading to larger pressure from this activity.	↗
Fishing	High socioeconomic importance for the region (direct and indirect employment, wealth creation, local identity etc.). While fishing activity occurs outside the CS area, 6% of all fish landing in continental Portugal occur in the Aveiro port (one of the busiest ports in the country), located in the CS area. Increase in catches between 2002-2012, 17% decrease in registered fishermen. Increase in price for migratory and freshwater fish may impact future trends in catches, however it is as yet unclear if the results will be positive or negative for biodiversity and for human wellbeing in the CS area. The collection of shellfish and bait digging is common along the shallow subtidal and intertidal flats. The relative abundance and increase in commercial value may lead to an increase in activity (PGRH4A, 2016). A distinction must be made between subsistence/recreational and commercial activity, with the former being informal and particularly relevant following the economic crisis, and the latter regulated through permits.	↗
Tourism	Tourism provides 6% of employment in the Ria de Aveiro region. (Albuquerque 2013). As saltpans in the area are being abandoned, two have been converted to support water-based/related tourism (e.g., mud baths, bird watching, spas	↗

	etc.), in turn supporting an increase in tourism activity in the area (Dolbeth et. Al 2016). Between 2002-2012 there was an increase in value of the regional tourism offer more than doubled (Sousa et al 2015). The new national tourism strategy will increase promotion of the region and includes increasing port traffic from Cruisesas an aim, which is a novel form of tourism for the region.	
Energy	The Ria de Aveiro is affected by 5 hydroelectric infrastructures (Administração da Região Hidrográfica do Centro I.P., 2016). High pressure (in terms of run-off, section of waterline < 1 km) due to hydroelectric systems (e.g., Systems of Palhal and São Pedro do Sul) (Administração da Região Hidrográfica do Centro I.P, 2016). No installations are expected in the CS area.	→

Table ix: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers						Threats potentially tackled						Key features	Link to EU policy
	Agriculture	Aquaculture	Fishing	Tourism	Port	Energy	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Sectoral Plan for Natura 2000 Network	X	X	X	X	X	X	✔	✔	✔	✔	✔	✔	Territorial management tool for implementation of conservation and biodiversity policy in Portugal, which acts through the restriction and regulation of human activities in protected areas should.	BD and HD
													May increase pressures from tourism due to the Natura 2000 park brand.	
													Contributes to coordination across different territorial and administrate scales in order to contribute to biodiversity conservation at the national level.	
													Measures implemented through the Ria de Aveiro Intermunicipal Master Plan	
RBMP for Vouga, Mondego and Lis	X	X	X	X	X	X	✔		✔	✔	✔	✔	The RBMP outlines measures to be taken in order to reach GE status/potential. More concretely, here are some measures defined for Aveiro WB2 (highly modified water body, for which hydro-morphological alterations have been identified as a significant pressure.	WFD
FRMP for Vouga, Mondego and Lis	X	X	X	X	X	X					✔		The plan identifies 2 critical areas for flood risk management in the CS area: Ria de Aveiro (29 measures planned; 16 preparation; 5 protection; 4 prevention and rehabilitation) and Águeda (16 planned measures for distributed evenly among types of measures).	Floods Directive, WFD, BD, HD
													The plan contemplates the implementation of both green and grey infrastructures to address flood risk for the region.	
Coastal Zone Managemeent Programma Ovar-Marinha Grande section	Y	X	X	X	X	X	✔			✔	✔		The majority of funding for this plan is directed to-wards Protection of the coastal zone (85%), in particular on beach nourishment	
													The improvements and installations contemplated may increase tourism as they support the increase and diversification of tourism activities.	

Vouga Estuary Programme	Y	Y	Y	Y	X	Y	✔	✔	✔	✔	✔	✔	Future plan that aims to conserve and enhance the estuary and promote its sustainable use of water resources, integrated management of water realms and their sediments, ensure functioning of estuarine ecosystem, and other threatened aquatic ecosystems, habitats and their species, and coordination between various territorial management instruments e.g., POC OMG, PSRN2000, UNIR@RIA, etc.).	(BH and HD)
Polis Litoral Ria de Aveiro	X	X	X	X	X	X					✔		Promotes coordination and collaboration among stakeholders, primarily members of the CIRA (Aveiro Region Inter-municipal Community) and the Portuguese state, who together for the Sociadede Polis Litoral de Ria de Aveiro S.A.	
													It was developed considering the environmental conservation needs including the environmental continuity needs of the Ria (i.e., maritime, lagoon and freshwater ecosystems that feed into the Ria), as well as socioeconomic development of the area. Furthermore, the advisory board for Sociadede Polis Litoral de Ria de Aveiro provides input from a multi-sectoral perspective (including representation from water supply and sanitation sector, biodiversity protection, maritime and port authorities, tourism sector, education sector, sanitation sector, as well as agriculture and fisheries).	
National Strategic Plan for Climate Change and Programme AdaPT	X	X	X	X	X	X		✔	✔	✔	✔		These are the two main instruments for climate change adaptation in Portugal.	
													The ENAAC is structured around 4 objectives: 1) collecting and consolidating information and knowledge to develop a strong technical and scientific base for action; 2) reducing vulnerability and increasing response capacity, which is the core work of the ENAAC; 3) participation, awareness raising, and dissemination; and 4) international cooperation, linking with efforts from the EU, UNFCCC and other international for a that promote coordination and cooperation internationally. The ENAAC uses a sectoral approach with 9 priority sectors and sectoral working groups: territory and urban development; water resources; safety of people and goods; human health; energy and industry; tourism; agriculture; forests and fisheries; coastal areas and, biodiversity. The aim of this structure is to harness knowledge and know-how in order to identify vulnerabilities and opportunities for adaptation.	

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

Table x: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity in Aveiro

Sectoral Policies	Drivers						Key Threats						Key features	Link to EU policy
	Agriculture	Aquaculture	Fishing	Tourism	Ports	Energy	Nitrogen Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Tourism Strategy 2027				Y	X		✔		✔		✔	✔	Strategy affirms the importance of tourism for Portugal, and sets out to position Portugal as a competitive and sustainable tourist destination.	Communication (COM/2010/0352 final) Europe, the world's No. 1 tourist destination
													The strategy includes economic, social and environmental aims. The latter is focused on promoting resource efficiency (energy, water and solid waste) in tourism companies.	
National Action Plan for Renewable Energy 2013-2020 (PNAER 2020)						X					✔		At national level, in 2016 31.3% of energy came from hydro-power; in 2017 this figure dropped to 14.1%.	Directive (2009/28/EC) on the promotion of the use of energy from renewable resources , ERDF
													31% target for renewable energy in gross final consumption, and 10% for transport by 2020 and 59.6% renewables in electricity production.	
													Within MFF framework, 12-15% of ERDF funding should be allocated to low-carbon economy shift	
RDP Portugal 2014-2020	X						✔		✔		✔		Available funding for 2014-2020 period: €7,8 Billion (46% EAFRD)	CAP, EAFRD
													47% of funding is dedicated to Axis 3, environment, efficiency in the use of resources and climate (€3,698,317,190)	
Mar2020 (Operational Programme for the EMFF)		X	X		X		✔	✔		✔	✔	✔	Supporting the adjustment of the Portuguese fleet fishing effort to the available fishing resources, the use of more selective fishing gear, fleet modernisation, protection of marine resources, establishment of marine protected areas and the modernisation of fishing infrastructures (landing sites, ports and shelters), so as to achieve sustainable management of the fisheries sector at biological, environmental and economic level. Budget: €103.6 Million (26 % of EMFF al-location)	Regulation 508/2014, EMFF
													Supporting the competitiveness and the environmental and economic sustainability of the aquaculture sector, mainly through the development of joint support facilities and infrastructures, investments aiming to increase the efficiency of aquaculture units, promotion of aquaculture products in new markets and the development of maritime spatial planning. Budget: €59 Million (15 % of EMFF allocation)	

Ria de Aveiro Intermunicipal Master Plan	X	X	X	X	X		✔	✔	✔	✔	✔	✔	This instrument was developed using an integrated approach in order to consider environmental aspects alongside socioeconomic growth for the area.	BD and HD (via link to national level policy instrument, the Sectoral Plan for Natura 2000)
													An emphasis on the revitalisation of the tourism sector (94% of measures address this aim) and urban settlement planning (76% of measures address this issue) can be observed and may indicate an internal bias. By way of comparison, the promotion of traditional activities (which include smallholder agriculture and saltpans) and those compatible with nature conservation is addressed by 69% of measures under this plan.	
Regional Spatial Plan for the Centre	X	X	X	X	X	X					✔		This instrument aims to support socioeconomic development of the central region. This development may increase pressures from numerous sectors, especially when the importance of the Aveiro port, one of the busiest port in the country, is taken into account. Funding sources include ERDF and EMFF	

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 6: Understanding eutrophication processes and restoring good water quality in Lake Ringsjön – Rönne å Catchment in Kattegat, Sweden

Member States with jurisdiction	Policy framework
	

Overview

Rönne å catchment area is a river watershed located in Southern Sweden and includes lakes (e.g., Ringsjön), rivers (Rönne å) and marine coastal areas (Kattegatt). The primary landuse in the region is agriculture, which intensified during the period of production increase after the 1950s. Local population growth has also put pressure on the environment with increasing municipal sewage treatment needs and the conversion of rural dwellings where sewage treatment is difficult to regulate. Comprehensive changes to agricultural approaches has meant a reduction in negative externalities from the 1970s. However, the resulting changes have been slow in becoming apparent in the watershed and there is continuous work by the local water council to experiment with approaches such as biomanipulation to achieve results.

What is threatening aquatic biodiversity in Rönne å?

For the research in our case study, this case study focuses on nutrient pollution, particularly phosphorus, as the main threat to water quality. Eutrophication is caused by nutrient leakage from **agricultural practices** and discharges from insufficiently treated water from **municipal sewage** treatment plants.

Trends in the impacts of threats on aquatic biodiversity

- The lakes of Ringsjön had an unsatisfactory ecological status in the 2010–2016 assessment, although the measured Secchi depth during that period has been gradually increasing indicating a gradual increase in water quality. The other lakes in the catchment – Västersjön and Rössjön – had good ecological status.
- Most rivers in the catchment were classified as moderate ecological status in the 2010–2016 assessment, although there were also a number of unsatisfactory and bad ecological status classifications in the catchment.

▸ In Ringsjön, the surface samples of total phosphorus have decreased from highs of around 350 µg/l in the 1970s to around 75 µg/l in 2010. Nitrogen has decreased from highs of 3,500 µg/l to 1,250 µg/l in the same time period.		
What is driving nutrient pollution in Rönne å?		
Agriculture	The county of Skåne (the site of this study) is a region dominated by intense farming and a relatively large population. In 1995, over 50% of nitrogen leakage and ca 25% of phosphorus leakage originated from agricultural land. However, there have been nutrient reduction measures implemented in the region, with corresponding reductions in nitrogen and phosphorus concentrations. In the Skagerrak and Kattegat Water District (containing the Rönne å catchment), crop distribution has been changed with a reduced proportion of area sown with spring crops, and increased area sown with ley production. Catch crops have also been cultivated in line with environmental measures. Changes in the use of agricultural land and more efficient use of nutrients resulted in an annual reduction of nutrient leaching from arable land of 12% nitrogen and 7% phosphorus. In Sweden, the primary sector (agriculture, forestry, fisheries) represents a relatively low contribution to the national economy with 1.3% of the GVA. The EU28 average is 1.5%. The number of Swedish farms are decreasing, however, the size of farms are increasing. The average size of farms is particularly high, when compared with other EU28 countries (45.2 vs. 16.1 ha). Agriculture in Sweden covers 1.5% of all full time employment takes place in the agricultural sector. In Sweden, the primary sector (agriculture, forestry, fisheries) represents a relatively low contribution to the national economy with 1.3% of the GVA. The EU28 average is 1.5%. The number of Swedish farms are decreasing, however, the size of farms are increasing. The average size of farms is particularly high, when compared with other EU28 countries (45.2 vs. 16.1 ha). Agriculture in Sweden covers 1.5% of all full time employment takes place in the agricultural sector.	↘
Sewage treatment	Wastewater treatment in Sweden developed substantially in the 1960s and 70s and today, households in urban areas are connected to municipal sewage networks where 95% of wastewater goes through both biological and chemical treatment. However, an estimated 750,000 properties in Sweden are not connected to the municipal wastewater treatment plants, and only around 60% of these are thought to have installations that meet the requirement of the Environmental Code. The amount of phosphorus released from this type of wastewater disposal is more than half the total amount discharged from the municipal wastewater treatment plants.	→

Table xi: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers		Threats potentially tackled						Key features	Link to EU policy
	Agriculture	Rural Wastewater Treatment	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Swedish River Basin Management Plans	Y	Y	✔						River Basin Management Plans and Programmes of Measures are produced on a six-year cycle, which include the analysis of water status and defined environmental quality objectives. Environmental objectives are established for 2015, 2021 and for certain RBDs and water bodies for 2027.	WFD; Bathing Waters Directive; Drinking Water Directive; Urban Wastewater Directive; Nitrates Directive
Environmental Code	Y	Y	✔						Central legislation on environmental issues in Sweden, including sectoral legislation developed before 1999. - Environmental quality standards, regulating the environmental impact of diffuse emission sources - Action programme for a reduction of nutrient losses in agriculture - Specific demands regarding on-site toilet wastewater treatment for those not connected to municipal wastewater treatment facilities	WFD incorporated into Ch 5 EU Nitrates Directive - Ch 12 EU Urban Wastewater Directive
	Y	Y	✔						Seven of the 16 Environmental Quality Objectives directly target water quality management, the most relevant one being "Zero Eutrophication", but also: • No. 8 Flourishing Lakes and Streams • No. 9 Good Quality Groundwater • No.10 A Balanced Marie Environment, Flourishing Coastal Areas and Archipelagos • No. 11 Thriving Wetlands • No. 13 A Varied Agricultural Landscape.	WFD incorporated into Ch 5 EU Nitrates Directive - Ch 12 EU Urban Wastewater Directive
Swedish Rural Development Programme	Y		✔						Includes payments for environmentally friendly farming methods including reducing nutrient leakage, such as - cover/catch crops, spring tillage, riparian buffer zones, wetlands, ley cultivation etc.	EU Rural development Programme

"Focus on Nutrients" Programme	Y		✔						Gives farmers advice on how to reduce nutrient surplus and protect water quality. Training provided to farmers. Funded by the Swedish Rural Development Programme.	EU Nitrates Directive
Local environmental objective programmes	Y	Y	✔						Municipality plans containing an action strategy in order to meet the Environmental Quality Objectives within the municipality	EU Water Framework Directive
Strategy for Sustainable Development	X		✔	✔					The Strategy focuses, amongst others, on the following topics: Nature conservation and biological diversity, creating a non-toxic environment.	EU Sustainable Development Strategy
Swedish strategy for biodiversity and ecosystem services	X		✔	✔		✔			The Strategy focuses on achieving the targets of the UN Convention on Biological Diversity by, amongst others, increasing biodiversity protection measures and establishing more marine reserves. It includes measures for endangered species and genetic diversity. A special focus lies on integrating ecosystem services in accounting and decision making of public authorities as well as companies.	EU Biodiversity Strategy
National strategy for prioritizing water measures within agriculture	X		✔						The strategy's aim is to minimize the physical impact of agriculture on water by developing a decision support system that aims amongst others to increase cooperation between agriculture and water authorities.	

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

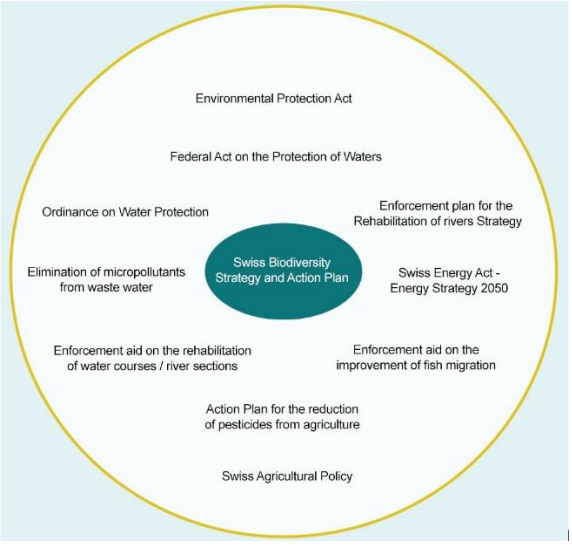
Table xii: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity

Sectoral Policies	Drivers		Key Threats						Key features	Link to EU policy
	Agriculture	Rural Wastewater Treatment	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Agricultural Policy	X		✔						The aims of the CAP are to increase agricultural productivity, ensure reasonable standard of living for farmers, stabilise agricultural markets and to ensure supply of agricultural produce at reasonable prices for consumers. In the period from 2014–2020, EUR 4.9 billion is allocated to Sweden's direct payment scheme under CAP. 30 % of these direct payments will be linked to environmentally friendly measures: crop diversification, maintaining permanent grassland and conserving 5 % of areas of ecological interest.	EU CAP
A national food strategy for Sweden – more jobs and sustainable growth throughout the country	X		✔						The government wants to produce more food in Sweden, to support rural communities but also to ensure food security. The strategy is set until 2030. Objectives are an increase in food production and improvement of the food supply chain competitiveness. Future policies should be designed to support increased productivity. Investments will also cover innovation and research. Investments under this strategy will be more than SEK 1 billion by 2019 (over EUR 95 million).	CAP
A rural development programme for Sweden	X		✔						The total budget for the Rural Development Programme for the 2014–2020 programme period is approximately EUR 4.3 billion. Measures under the programme include funding for farmers to improve their competitiveness and production.	EU Rural development Programme
Municipality comprehensive plans		X	✔						The Planning and Building Act creates the responsibility for municipalities to establish a plan for the entire municipality area. Other legislation guiding the plan includes the Environmental Code, Planning and Building Ordinances, building regulations, Public Water Services Act, Real Estate Property Formation Act and the Housing Supply Act.	
Swedish strategy for biodiversity and ecosystem services	Z		✔						The strategy also covers changes in legislation that clarify under which conditions agricultural measures may exceptionally be carried out in protected biotopes, if the biotope's protective purpose is not endangered. This may be a risk if the clarification leads to the exemption clause being used more often.	

Strategy for a competitive agricultural and horticultural industry	Y		✔						The strategy aims for a growth of the Swedish agricultural and horticultural sector for which politics should set a favourable framework. Businesses should aim to raise productivity and adapt to markets.	

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 7: Biodiversity management for rivers of the Swiss Plateau

Member States with jurisdiction	Policies affecting CS7
	

Overview

The Swiss Plateau ecosystem is encompassed by the Jura Mountains in the North and the Alps in the South and covers an area of ca 11. 000km^2. It represents the most densely populated area of Switzerland, covering about one third of the total area and inhabited by about two thirds of the population (on average ca 380 inhabitants per km^2). Human activities dominate the land cover and include agricultural activities, forestry and urban settlements, in addition to industrial production and hydropower generation. Cumulative impacts driven by various human activities importantly affect aquatic biodiversity in the Swiss Plateau. A significant loss in biodiversity could be identified in the aquatic ecosystems of the Swiss Plateau, and even though the Swiss government put forward environmental conservation actions which reduced the trend in biodiversity loss, the trend could not be reversed so far. Important hydroenergy activities within the Swiss Plateau, in addition to flood protection and land gaining activities for settlements and agriculture, have led to major morphological river modifications, which in turn have affected biodiversity loss.

The Swiss federal government decided on a river rehabilitation strategy, which aims to restore 15,000km of stream networks in Switzerland, therefore including rivers of the Swiss Plateau, that are considered to be in a bad ecological state within the next 80 years. Annually, the federal government provides 40 million Swiss Francs for the Rehabilitation of rivers Strategy.

What is threatening aquatic Biodiversity in the Swiss Plateau?

The main drivers threatening aquatic biodiversity in the Swiss Plateau are **agriculture**, which is causing pollution from nutrients (in particular nitrate levels) and **hydroenergy**, which has contributed significantly to alterations to morphology in the Swiss Plateau. Nutrient pollution, including micropollutants, in Swiss waterways shows highest concentrations in the Swiss Plateau. Regarding morphology, below 40% of waterways in the Swiss Plateau are in natural conditions, however about 22% were assessed as slightly modified, 18% as strongly modified, 9% as artificial and 14% as channeled underground.

Trends in the impacts of threats on aquatic biodiversity

▸ The Swiss Federal Office for the Environment (FOEN) states that aquatic biodiversity in the Swiss Plateau is threatened, as is shown by a higher number of endangered species when compared with other habitats (including IUCN Red List species). ▸ More than 20% of endangered or extinct species in Switzerland are bound to waters, and another-fifth to shores and wetlands. 60% of aquatic plants are threatened - by far the highest value of all ecological plant groups . Only about 25% of the fish and round mouths species are considered "not endangered". ▸ Trends on the number of endangered species are increasing.		
What is driving biodiversity loss in the Swiss Plateau?		
Energy	The building and maintenance of hydropower plants has greatly contributed to morphological alterations in the Swiss Plateau. Renewable energy production from hydropower within Switzerland's is the most important domes-tic source of renewable energy and covers 56% of the national energy needs. The Federal Energy Act aims to increase the average annual production of electricity from hydropower to 38,600 gigawatt hours (GWh) by 2050 (by 2035 to 37,400 GWh), as part of its Energy Strategy 2050.	↗
Agriculture	Switzerland aims for a sustainable and market-oriented agriculture production that should make a significant contribution to the secure supply of the population, the preservation of natural resources, the cultivation of the cultural landscape and the polycentric colonisation of the country. Agriculture's share in the gross value added of the Swiss economy fell from 1.5% to 0.7% between 1995 and 2013. Agriculture's share in the gross value added with-in the primary sector amounted to 91%. Overall, a reduction in the number of farms and people working in the industry, due to technical progress can be seen. Between 1996 and 2013, the number of Swiss farms decreased from 79,500 to 55,200. However, at the same time the average area used for agricultural activities per farm in-creased by 5.4 hectares and now covers 19 hectares (this represents an increase of 40%). Between 2000 and 2013 the utilised agricultural area declined by 22,600 hectares (FSO, 2015). Sales of pesticides in Switzerland remained stable between 2011 and 2014, even though the area used for agriculture decreased. In particular the use of nitrogen fertilizers stayed constant (and high) between 2002 and 2013).	→

Table xiii: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers		Key threats						Key features	Link to EU policy
	Energy	Agriculture	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Environmental Protection Act		Y	✔	✔					Aims to sustain the natural foundations of life, especially biodiversity and soil fertility.	Not EU, but links to EU environmental policy, e.g. Habitats Directive
Swiss Biodiversity Strategy and Action Plan	X	X	✔	✔			✔		National strategy in line with the UN Biodiversity strategy.	CBD. Although not part of EU, comparable to EU Biodiversity Strategy
		X	✔						Refers to measures aiming to protect biodiversity in agricultural used areas in the 2014-2017 Agricultural Policy (see sectoral policies below).	
		X	✔						Aims to increase education and awareness of farmers of biodiversity benefits (i.e., environmental and commercial benefits).	
	X						✔		Conflicts between hydropower and biodiversity, particularly in the context of Energy Strategy 2050, shall be minimised through existing strategies and recommendations.	
Federal Act on the Protection of Waters	X		✔	✔	✔		✔		Lessen most negative impacts from hydropower plants by 2030 through the introduction of structural measures, without restricting the level of electricity production.	Although not part of EU, comparable to WFD
	X				✔		✔		Legal basis has been created for maintaining natural conditions in streams and rivers below hydropower plants (Kampa et al, 2011).	
Ordinance on Water Protection (adopted in 1998) , which implements the Federal Act on the Protection of Waters		X	✔	✔	✔		✔		Aims to regulate sewage discharges from urban activities and addresses the pressure of nutrient pollution in waterways. Requests measures to be in place in case of storm water overflows.	Although not part of EU, comparable to WFD
		X	✔		✔		✔		Demands a proper operation of industrial and agricultural installations, and informing authorities on monitoring results	

		X	✔		✔		✔		Sets definitions for water quality standards (i.e., turbidity, chemical status, oxygen levels, bathing water and drinking water quality).	
Enforcement plan for the Rehabilitation of rivers Strategy	X				✔		✔		Feature of Federal Act on the Protection of Waters. It aims to re-store waters as semi-natural habitats and thus contributes to their conservation and improvement of biodiversity conditions.	Not EU, but comparable to WFD
	X				✔		✔		It foresees that the space of restrained waters should be enlarged and the negative impact of hydropower should be reduced. Hydropower plant operators are compensated by the government for adapting their existing plants.	
	X								Financed by 40,000 million Swiss Francs annually (government).	
Enforcement aid on the rehabilitation of water courses / river sections (part of the Rehabilitation of rivers Strategy)	X				✔		✔		Designates priority areas for the rehabilitation of waters and sections of water, where the greatest possible effect for the restoration of the natural functions in relation to the effort can be achieved.	Not EU, but comparable to WFD
	X				✔		✔		Funding amount depends on the length of rehabilitated waterways.	
Enforcement aid on the improvement of fish migration (part of the Rehabilitation of rivers Strategy)	X				✔		✔		Strives to re-establish the migration corridors for fish, both up and downstream	Not EU, but comparable to WFD
	X						✔		Prioritise on reducing the effects of obstacles that are difficult or impossible to pass for fish.	
Elimination of micropollutants from waste water - Method for the extended elimination in sewage treatment plants		Y	✔					✔	Add a treatment step to reduce the concentration of polluting substances in wastewater. E.g. powdered activated carbon adsorption or ozonation, which should be applied to ca. 15% of the larger existing WWTPs in Switzerland.	Not EU, comparable to Urban Waste Water treatment Directive, but going beyond it
		Y	✔					✔	Regardless of whether a WWTP needs to be expanded or not, all WWTP will in future pay into a fund managed by the FOEN. The fund will pay WWTP expansions (source-based financing).	
Action Plan for the reduction of pesticides from agriculture		X	✔						Reduce risks associated with agro-chemical usage and the river sections not complying with water quality standard by 50% by 2027.	Not EU, but comparable to Sustainable Use of Pesticides Directive
		X	✔						Technical upgrades will be financed with direct subsidies. Furthermore, consultations and education/training programmes will be financed by the cantons.	Not EU, but comparable to Sustainable Use of Pesticides Directive

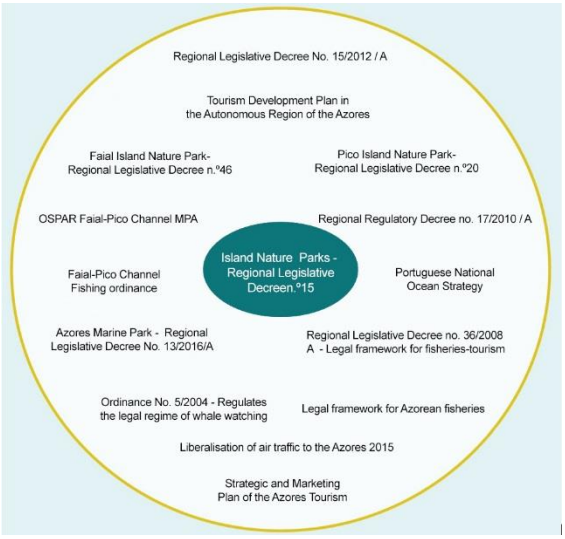
X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

Table xiv: Local Policy Mechanisms that Directly or Indirectly lead to Threats to Aquatic Biodiversity in the Swiss Plateau Case Study

Sectoral Policies	Drivers		Key Threats						Key features	Link to EU policy
	Energy	Agriculture	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Swiss Energy Act – Energy Strategy 2050	Y						✔		A package of measures aimed at promoting renewable energies and energy efficiency in the electricity sector, mainly cost-covering remuneration scheme for electricity generated from renewable energies.	Not EU, but comparable to EU Renewable Energy Directive and EU 2020 Energy Strategy
	Y						✔		Increase the average annual production of electricity from hydropower to 38,600 gigawatt hours (GWh) by 2050 (by 2035 to 37,400 GWh).	
									National high-tension grid operator Swissgrid reimburses operators of existing HPP for the costs of mitigation measures as required by the Water Protection Act and the Federal Law on Fisheries	
Swiss Agricultural Policy (based on Federal Law on Agriculture (1998))	X		✔						Aims to strengthen agricultural production and improve farm in-comes.	Not EU, but comparable to EU Common Agricultural Policy
	X		✔						In 2013, the Swiss Confederation spent CHF 3.7 billion on the agricultural and food sectors, 78% was paid to eligible farms in the form of direct payments and social contributions.	
									2014–2017 Agricultural Policy reoriented direct payments to better target policy objectives, including for biodiversity.	

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

Case Study 8: Ecosystem-based solutions to solve sectoral conflicts on the path to sustainable development in the Azores

Member States with jurisdiction	Policies affecting aquatic biodiversity
	

Overview

The Faial-Pico Channel is a 240km² biodiversity rich Marine Protected Area (MPA) in the Azores, a North Atlantic island archipelago and Outermost Region of the EU. Due to the "large number of species, habitats and ecological processes", the Channel is considered one of the best examples of Macaronesian coastal ecosystems in the Azores. Local recreational and commercial fishers, tourism operators (including diving operators), and other locals and tourists value the Channel for the many ecosystem services it provides, including fish and recreational experiences. While dependent on the long-term sustainability of the ecosystem, these human activities occurring in the Channel place pressures on the ecosystem. While limited local data makes it difficult to identify state, trends, and causality, extraction of species is recognised as the most significant pressure, though emerging pressures from tourism may pose future challenges.

Managing biodiversity loss in the Channel is complicated by multi-level and overlapping responsibilities, with policy development and enforcement split across the local-level Nature Park of Faial and Nature Park of Pico, and the Azores-level Regional Directorate for Sea Affairs, who must consider local, Azorean, Portuguese, and EU policy targets.

What is threatening aquatic Biodiversity in the Azores

The main driver threatening marine biodiversity in the Faial-Pico Channel is **commercial fisheries** causing extraction of species, i.e. fish and shellfish. Fishing pressure from recreational fisheries is also contributing to the pressure. While not currently a significant pressure, swiftly increasing **tourism** may place additional pressures on the ecosystem in the future (e.g., litter, pressures associated with accompanying increased boat traffic, recreation, and infrastructure).

Trends in the impacts of threats on aquatic biodiversity

- Drawing on the limited channel data, qualitative stakeholder assessments, and similarly limited Azores-level data indicate that biodiversity and ecosystem state are declining but from a moderate to high environmental state.
- Limited data and monitoring at the local Faial-Pico Channel scale make assessing environmental state and trends difficult. This is also true at the Azores level, as some MSFD indicators are yet still to be determined.

What is driving biodiversity loss in the Azores?		Trend
Commercial fishing	Extraction of species is driven by commercial fishing, which is historically important for the local economy in Faial-Pico. At the Azores-level, commercial fishing employs 1.5-3.2% of workers and the value of nominal fishing catch is equivalent to 0.7% of Azorean Gross Value Added. In Faial and Pico, fishing effort as indicated by the number of fishing vessels dropped 42% between 2004-2016, with total capacity (GT) falling by 20%. Working against this, local fish market prices show a fluctuating but upward trend.	→
Tourism	Scientific studies indicate that recreational fisheries place similar levels of pressure as commercial fisheries within the Faial-Pico Channel, although they are less well documented and regulated. Additionally, there is evidence of high non-compliance with existing recreational fishing regulations. Recreational boat fishing pressure is the largest, followed by angling, with a small amount of spearfishing.	↗

Table xv: Mapping of Local instruments contributing to reducing loss of aquatic biodiversity against drivers and threats targeted

Local policy instrument	Drivers		Threats potentially tackled						Key features	Link to EU policy
	Commercial fishing	Tourism	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Island Nature Parks – Regional Legislative Decree n.°15 / 2007 / A (superseded by Regional Legislative Decree No. 15/2012 / A of April 2)	X	Y		✓					Standardise and improve management and administration of protected areas; create Island National Parks that are responsible for managing terrestrial protected areas as well as marine/coastal areas within 12 nautical miles of the respective islands coast (including Faial-Pico Channel).	Birds and Habitats Directives, MSFD, Biodiversity Strategy
Regional Legislative Decree No. 15/2012 / A of April 2	X	Y		✓					Implement international and EU environmental directives (including Birds and Habitats Directives and Convention of Biological Diversity) in the Azores.	Birds and Habitats Directives, Biodiversity Strategy Bern Convention, the Bonn Convention, Convention on International Trade in Species of Fauna and Flora Threatened (CITES), Ramsar Convention.
Pico Island Nature Park- Regional Legislative Decree n.°20 / 2008 / A, July 9 AND Faial Island Nature Park- Regional Legislative Decree n.°46 / 2008 / A , November 7	X	X		✓					Consolidate management of all of each islands protected areas (including those that fall within 12 nautical miles of the coast) to better protect biodiversity, including half each of Faial-Pico Channel.	Birds and Habitats Directives, MSFD, Biodiversity Strategy
OSPAR Faial-Pico Channel MPA	X	Y		✓					Aims to protect biodiversity through the creation of Marine Protected Areas.	Biodiversity Strategy
Regional Regulatory Decree no. 17/2010 / A of 21 September 2010	X	Y		✓					Establish Regional Directorate for Maritime Affairs (DRAM) as a transversal ministry responsible for the conservation of nature in the marine environment.	Birds and Habitats Directives, MSFD, Biodiversity Strategy
Azores Marine Park – Regional Legislative Decree No. 13/2016/A	X	Y		✓					Protect and manage marine areas protected for environmental reasons located in the seas of the Azores, excluding those within Island National Parks (i.e., beyond 12 nautical miles from an island).	Birds and Habitats Directives, MSFD, Biodiversity Strategy
Faial-Pico Channel Fishing ordinance no. 53/2016	X	Y		✓					Increases restrictions on recreational and commercial fishing in three high-biodiversity locations in the Faial-Pico Channel.	CFP, MSFD, Biodiversity Strategy

Regional Legislative Decree no. 36/2008 / A – Legal framework for fisheries-tourism	X	Y	✓	Allows commercial fishers to gain licenses to use their boats for tourism activities, such as whale watching or touristic fishing, Potentially reducing extraction of species.	Birds and Habitats Directive, MSFD, Biodiversity Strategy
Ordinance No. 5/2004 of 29 January – Regulates the legal regime of whale watching		X		Regulates the number of whaling boats around whales and how close they can approach.	Biodiversity Strategy, MSFD

X The respective driver is explicitly mentioned in the text of the local policy instrument
Y The policy has the potential to address the respective driver

Table xvi: Local policy mechanisms that directly or indirectly lead to threats to aquatic biodiversity in the Azores

Sectoral Policies	Drivers	Key Threats						Key features	Link to EU policy
	Commercial fishing	Tourism	Nutrients Pollution	Species Extraction	Water Abstraction	Invasive Alien Species	Alterations to Morphology	Plastic Waste		
Common Fisheries Policy (CFP) (Regulation (EU) 1380/2013) and European Maritime and Fisheries Fund (EMFF)	X			✓					Authorises Member States to exclude access to waters up to 100 nautical miles from the baselines of Outermost Regions to Union fishing vessels not registered in the ports of Outermost Regions until 31/12/2022 (Article 5(3)). I.e. derogation from CFP general rule that all EU fishing vessels have equal access to all waters.	CFP and EMFF
	X			✓					Outermost region governments are also allowed to provide additional state aid to support fishers than Member States (85% state aid relative to max 50% for Member States); for example to modernise boats or support supply chains.	
Portuguese National Ocean Strategy	Z			✓					This Portuguese-level strategy includes the Azores, which aims to protect biodiversity and fish stocks through marine spatial planning (MSP) development.	MSFD, CFP, Biodiversity Strategy
Legal framework for Azorean fisheries (29/2010/A and 31/2012/A) (and other subsidary regulations)	X			✓					Establishes a framework for sustainable management of fisheries in the Azores and of the fishing industry. Has both positive and negative impacts on fishing as a threat.	CFP, MSFD
	X			✓					Numerous Azorean and local laws that manage particular aspects of fishing in the Azores supplement this overarching law. These include local regulations (such as the Faial-Pico Channel Fishing Ordinance no. 53/2016) as well as ordinances focussed on particular gears or techniques.	
Strategic and Marketing Plan of the Azores Tourism (PEMTA) (2016)		X							PEMTA establishes measures to increase the amount and positive impact of tourism in the Azores.	NA
Tourism Development Plan in the Autonomous Region of the Azores (POTRAA) (2008)		X							Promote balanced economic and social development through a tourism, while ensuring environmental sustainability.	NA
March 29, 2015 liberalisation of air traffic to the Azores		Y							Allow more flights and entrance of low-cost carriers to the Azorean airline market	NA

X: Direct support (funding mechanisms) that increase threats to aquatic biodiversity
Y: Encouraging a change of sectoral practices that leads to increase the threat
Z: Promotion of the threat through new practices by changing the regulatory landscape

AQUACROSS PARTNERS

Ecologic Institute (ECOLOGIC) | Germany
Leibniz Institute of Freshwater Ecology and Inland Fisheries (FVB-IGB) | Germany
Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO) | France
Stichting Dienst Landbouwkundig Onderzoek (IMARES) | Netherlands
Fundación IMDEA Agua (IMDEA) | Spain
University of Natural Resources & Life Sciences, Institute of Hydrobiology and Aquatic Ecosystem Management (BOKU) | Austria
Universidade de Aveiro (UAVR) | Portugal
ACTeon – Innovation, Policy, Environment (ACTeon) | France
University of Liverpool (ULIV) | United Kingdom
Royal Belgian Institute of Natural Sciences (RBINS) | Belgium
University College Cork, National University of Ireland (UCC) | Ireland
Stockholm University, Stockholm Resilience Centre (SU-SRC) | Sweden
Danube Delta National Institute for Research & Development (INCDDD) | Romania
Eawag – Swiss Federal Institute of Aquatic Science and Technology (EAWAG) | Switzerland
International Union for Conservation of Nature (IUCN) | Belgium
BC3 Basque Centre for Climate Change (BC3) | Spain

Contact aquacross@ecologic.eu
Coordinator Dr. Manuel Lago, Ecologic Institute
Duration 1 June 2015 to 30 November 2018

Website http://aquacross.eu/
Twitter @AquaBiodiv
LinkedIn www.linkedin.com/groups/AQUACROSS-8355424/about
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