

Analysunderlag för mål 14 i Agenda 2030

Analysunderlaget utgår från de åtta broschyrer som Havs- och vattenmyndigheten tog fram inför FN:s havskonferens 2017.

Havsmiljöinstitutet har haft i uppdrag att uppdatera broschyrerna. Det är forskare och experter från universitet samt övriga berörda organisationer och myndigheter som har bidragit med uppdateringar. Sakexperter från Havs- och vattenmyndigheten har gjort en slutlig granskning.

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<https://www.havochvatten.se/hav/samordning--fakta/internationellt-arbete/internationellt-samarbete/fns-havskonferens/analysunderlag-till-fns-havskonferens.html>

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Swedish efforts within a Source-to-Sea continuum

Executive summary

WHAT RESEARCH SUGGESTS

- There are strong linkages between Sustainable Development Goal (SDG) 14 and other SDGs, especially SDG 6, that call for a holistic, ecosystem-based and integrative approach to the implementation of SDG 14 and its targets.
- A Source-to-Sea (S2S) approach supports an ecosystem approach in policy, planning, and decision making that considers the entire social, ecological, and economic system from source to sea.
- A common vision and agreement on goals and targets between key stakeholders is essential in all S2S systems, from a watershed to a river basin, in a regional sea or at the global scale.
- In any S2S system there are geographic segments that are connected by key flows of water, sediment, pollution, biota, material, and ecosystem services.
- Measures defined in an S2S system should be designed to support positive feedback loops and enhance ecosystem services while tackling flows that degrade connected ecosystems.
- A key element of an S2S approach is to understand how governance approaches have changed over time to support new courses of action.
- The Action Platform for Source-to-Sea Management aims to facilitate contact between decision makers and experts to provide on-demand knowledge, support, advice and guidance to coordinated policymaking and implementation from land, freshwater, coast to ocean. The initiative has led advocacy and outreach efforts to promote source-to-sea management and encourage its adoption in technical and policy processes.

WHAT SWEDISH EFFORTS ILLUSTRATE

- Sweden is supporting the work of the Action Platform for Source-to-Sea Management (S2S Platform) to promote S2S approaches at a larger and more systematic scale in international efforts.

- National S2S approaches are linked to the implementation of EU policies and directives, and Sweden’s national Environmental Objectives.
- Multilateral collaboration supports comprehensive S2S policy development as illustrated by the Baltic Sea and North East Atlantic regions. Cooperation enables joint environmental monitoring and the setting of common indicators.
- At the global level, Sweden provides important contributions to S2S programs and project development.
- The Swedish Government decided in 2018 on the new Swedish strategy for global action on the environment, climate, ocean and natural resources for the period 2018-2022. This is the first time the ocean is explicitly included as a priority area for the Swedish global development cooperation.
- The Swedish Agency for Marine and Water Management has in their Strategy for international development cooperation 2018-2020 focus on strengthening the Source to Sea perspective in Agenda 2030.

WHAT INTERNATIONAL EFFORTS ILLUSTRATE

- Water and marine governance policies need to be better coordinated from an upstream to a downstream perspective and linked to broader policy objectives in other sectors.
- Management and coordination efforts across national boundaries need to increase in several policy areas, such as environment, agriculture, fisheries, trade, business, and tourism, to achieve long-term sustainability.
- Source-to-sea management is essential to improve climate resilience particularly for the more vulnerable communities in coastal areas and the Small Island Developing States (SIDS).
- The S2S platform has released a guide for practitioners for implementation of the source-to-sea approach. The guide supports professionals to apply the source-to-sea approach during project design, implementation and evaluation.

Swedish efforts within a Source-to-Sea continuum

Introduction

The main threats to marine ecosystems are habitat disturbance, pollution (eutrophication, hazardous substances, and marine litter), over-fishing, and climate change. Many pressures originate from land-based activities and end up in the sea. These include direct pressures from production on land, such as agriculture, forestry and energy production, and through indirect pressures, such as consumption, all causing negative impacts on water quality and

ecosystem services. In addition, there are several pressures in or at the sea stemming from fisheries, transport, extraction of non-living-resources (mining, sand, oil, and gas) and point sources (industry and sewage treatment plants).

The Source to Sea (S2S) approach illustrates linkages between these pressures and activities. There are clear linkages and connections between SDG 14 “Conserve and sustainably use the oceans, seas and marine resources for sustainable development,” and other SDGs such as SDG 1 “No poverty”, SDG 2 “Zero Hunger” and SDG 6 “Ensure availability and sustainable management of water and sanitation for all”. This calls for a holistic and integrative approach to achieve SDG 14. The sustainable development of our oceans and the realisation of several targets depend on coordinating management efforts to achieve the SDGs across sectors and administrative borders.

This report gives examples of Swedish efforts in the S2S continuum from national, regional and global perspectives.

The S2S approach to governance and management

The S2S conceptual framework offers a way to recognise, in any given S2S system, relevant system linkages to support sustainable outcomes and is an aid in developing operational methods and tools to put S2S governance and management into practice.

The conceptual framework is designed around a set of key flows to help analyse ways of addressing negative aspects of flow alterations or enhancing positive ones (Fig. 1). These include biophysical flows of water, sediments, pollutants, biota, and material. Positive feedback loops and return flows that are strived for in supporting a blue or green economy are defined as ecosystem service flows such as clean water, food, and navigation.

Socio-economic drivers and pressures that alter the key flows and management action to date should be defined in order to identify a course of action. Stakeholder engagement is necessary in all steps of managing S2S systems considering that political and economic contexts change constantly. The S2S approach supports the coordination of processes and segments along the continuum from source to sea at the scale defined as a watershed, a river basin, or a regional sea to global system linkages such as marine debris and ocean acidification.

Marine litter is a global environmental problem that is growing, causing negative effects on marine life and the provision of ecosystem services as well as on socio-economic costs to our society as a whole. Marine litter originates from a variety of sources and enters the ocean from activities both on land and at sea, such as from commercial and recreational shipping. For example, research shows that more than 80 percent of the annual input of plastic litter, such as drink bottles and plastic packaging, comes from land-based sources. This suggests the importance of the source to sea approach.

National efforts

National efforts in Sweden within the S2S continuum are linked to the implementation of EU policies and directives, such as the European Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD), the Habitats Directive, the Maritime Spatial

Planning Directive (MSP), and the Common Fisheries Policy (CFP). These efforts include restoration of habitats in fresh water and marine environments, adapting hydropower to modern environmental standards, linking spatial planning on land with ongoing marine spatial planning processes, and management of marine protected areas and fishing reforms supporting an ecosystem-based fisheries management agenda.

The Swedish Agency for Marine and Water Management (SwAM) was created in 2011 to increase the integration of relevant policies to achieve a unified and coherent management of the aquatic resources in rivers, lakes, and the sea.

Sweden is divided into five water management districts for WFD. Each district has a river basin management plan including a programme of measures (PoM) and environmental quality standards for all groundwater and surface water bodies. Encouraging local stakeholder participation is one of the key processes of Swedish river basin management.

In 2015, Sweden established a PoM for the country's marine waters according to the MSFD. The programme consists of 32 measures spanning from awareness and legislation to physical activities. The measures address sources of different pressures such as input of nutrients, hazardous substances, and litter; biological pressures such as fisheries and invasive species; and include restoration of habitats and coordination efforts with other national agencies.

In Sweden, terrestrial and marine spatial planning are closely connected along the coastal zone. The comprehensive spatial planning responsibility by Swedish municipalities spans internal waters and includes parts of the territorial waters. The national marine spatial planning includes most parts of the territorial waters and the Exclusive Economic Zone, and coordination between the planning frameworks is being developed.

In 1999, the Swedish Parliament adopted the Environmental Objectives, a system of goals to guide Swedish efforts aimed at safeguarding the environment. There are strong S2S linkages in this national framework.

In 2018, the Swedish Government decided on the new Swedish strategy for global action on the environment, climate, ocean and natural resources for the period 2018-2022. This is the first time the ocean is explicitly included as a priority area for the Swedish global development cooperation. The strategy shall contribute towards implementing the 2030 Agenda. Marine pollutions, including marine litter and micro plastics, are challenges that shows the importance of a source to sea approach.

The Swedish Agency for Marine and Water Management has in their Strategy for international development cooperation 2018-2020 focus on strengthening the Source to Sea perspective in Agenda 2030 as well as strengthening the Swedish resource base and promoting collaboration with important marine and freshwater stakeholders based on a source to sea perspective.

Regional efforts

The multiple uses and pressures of water resources are clearly recognised in EU water policy. The WFD river basin planning system commits all EU member countries and enables water management in a holistic and transparent way. Sweden and other EU member countries follow the EU Blueprint to Safeguard Europe's Water Resources, a strategy to ensure good water quality that meets the needs of people, the economy, and the environment.

The EU Strategy for the Baltic Sea Region (EUSBSR) is an important tool for deepening cooperation between the countries around the Baltic Sea. The EUSBSR takes a broader policy and development perspective, addressing three interlinked objectives: save the sea, increase prosperity, and connect the region.

Sweden is engaged in multilateral policy collaboration in the Baltic Sea through the Helsinki Commission (HELCOM) and the Oslo-Paris Convention (OSPAR) for the North Sea. Sweden is also engaged in the Nordic Council. Both HELCOM and OSPAR apply an S2S approach by inclusion of pressures from terrestrial freshwater catchments in both marine conventions. Important key flows identified for management on a regional level are nutrients, hazardous substances, and litter. Sweden is committed to the HELCOM Baltic Sea Action Plan (BSAP), which includes actions for reducing hazardous substances and national nutrient reduction targets to restore the good ecological status of the Baltic marine environment by 2021. Sweden is co-lead for two regional actions within HELCOM's Regional Action Plans on Marine Litter (RAP ML), with the objectives of preventing and reducing marine litter in the fisheries sector and wastewater treatment plants. Sweden further works to strengthen collaboration between intergovernmental organisations in order to increase cooperation between water, marine, and fisheries management, such as between OSPAR and NEAFC (Northeast Atlantic Fisheries Commission) or the coordination of MPA and MSP processes.

Global efforts

On the global level, Sweden contributes to international collaboration, policy influence, and capacity building in accordance with the development goals in Agenda 2030. Sweden actively promotes improved cooperation and the establishment of collective arrangements between existing regional and global conventions and organisations to ensure a coherent and ecosystem-based management of marine resources. Sweden strives to increase regional and international collaboration through several international forums, including the GEF, FAO, OECD, UNEP, UNDP, CITES, Arctic Council, CCAMLR, IMO, and Regional Fisheries Bodies.

Sweden is actively working toward an implementation agreement to UNCLOS for the protection of marine bio-diversity in areas beyond national jurisdiction. Under the Convention on Biological Diversity (CBD), Sweden and other parties have adopted the ecosystem approach as the primary framework of the convention, defined as "a strategy for the integrated management of land, water, and living resources." Integrated basin-scale, coastal, and marine management, and control of land-based pollution sources are highlighted as priorities under the convention.

Sweden is strengthening its environmental commitment to the Arctic region by focusing on area-based conservation, monitoring and assessing acidification in the Arctic, co-leading the

project Marine Litter in the Arctic, and participating in several Arctic Council expert groups (MPA Expert Group, Ecosystem Expert Group, CAFF Marine Biodiversity Expert Group) that apply S2S approaches.

Sweden is engaged in bilateral cooperation with strategic countries within the fields of S2S. Exchanges of knowledge and experiences on the coordinated management of fresh and marine waters are developed with South Africa, China, Russia and Brazil.

As part of SwAM's program for development cooperation – SwAM OCEAN launched in 2019, Sweden engages in relevant activities and policy processes to promote the coordinated management of fresh and marine waters. The goal of these actions is to contribute to reduction of negative impacts from land-based sources on coastal and marine ecosystems and ensure well-functioning ecosystem services that poor people depend upon for their livelihood and food security.

The Swedish International Development Cooperation Agency (Sida) is one of the major financiers of the Mekong River Commission (MRC). The main objective of the MRC is to strengthen regional cooperation between the four member countries regarding hydropower development. S2S issues are increasingly gaining attention in the MRC, especially in the context of biota flows such as fisheries management and sediment flows. In the Red River, the IUCN implemented the Mangroves for the Future program (MFF) which supports S2S approaches in the cooperation between Vietnam and China. The river delta area between Hanoi and the river mouth in the South China Sea is one of the most important areas in the region contributing to poverty alleviation by supporting agriculture and fisheries production. Opportunities exist for scaling up S2S approaches in 11 coastal countries, which have rivers originating in the high mountain areas of the Himalayas, and supplying valuable nutrition to coastal and marine ecosystems in the East Asian seas.

Sweden is supporting the work of the Action Platform for Source-to-Sea Management (S2S Platform) to promote S2S approaches at a larger and more systematic scale in international efforts. Since its formation in 2014, the S2S Platform has established itself as a key player in the international policy arena by connecting actors between freshwater and marine management, developing a common problem formulation and knowledge-base in the form of a source-to-sea conceptual framework and by building commitment at global and regional levels for using a source-to-sea approach to resource management. The S2S Platform now includes more than 25 of the key UN organizations, research institutes, international environmental NGOs, conventions, intergovernmental sea and river basin commissions active in this field. In 2019, the S2S platform released a guide for practitioners for implementation of the source-to-sea approach. The guide supports professionals to apply the source-to-sea approach during project design, implementation and evaluation.

Outcomes of the S2S Platform

The Secretariat, supported by Platform partners, has led advocacy and outreach efforts to promote source-to-sea management and encourage its adoption in technical and policy processes. Activities that ensure S2S Platform presence at strategic international events and conferences provides an important basis for this work. The Swedish government continued

its support to source-to-sea management through earmarked funding to UNEP and the S2S Platform secretariat.

- The new UN Environment Marine and Coastal Strategy adopted at UNEA March 2019 makes reference to the "source-to-sea approach" as one of the guiding principles for the strategy, and includes source-to-sea related outputs under "Strategic Objective 2: Build circularity in our economies and promote sustainable consumption and production approaches to address marine pollution and resource use".
- The source-to-sea dimension was included in the Global Centre for Adaptation – Water Action Track, which aims to, by 2030 “support efforts in at least 100 river and groundwater basins to plan and finance climate adaptation and resilience measures, in view of the pivotal role of basins and the source-to-sea water cycle in fulfilling the 2030 agenda”.
- Source to sea linkages were higher on the agenda than ever at the “Blue COP” in Madrid. The S2S Platform was on the ground to better advocate for these linkages during official side events.
- Stronger commitments to source-to-sea action have also been tabled by organizations such as Asia Development Bank who have committed \$5 million USD to combatting marine litter through source-to-sea management.

National Gaps and Global Opportunities

To enhance SDG implementation in Sweden and beyond, an S2S approach can contribute to meeting sustainability by considering the strong system linkages in the socio-ecological systems. Gaps to be addressed in order to achieve an S2S approach include:

- Applying a system thinking along the S2S continuum to identify pressures and their drivers to tackle detrimental flows;
- Incorporating the role of ecosystem services and the significance of their connections across several SDGs;
- Supporting a robust framework of governance that takes into account sustainability objectives and indicators, and the fact that governance regimes evolve over time;
- Ensuring stakeholder participation to achieve ownership in all aspects of management in the S2S continuum;
- Articulating and connecting marine- and land-based spatial planning frameworks;
- Including green infrastructure approaches in all aspects of management in the S2S continuum;

- Applying ecosystem-based fisheries management approaches to secure the connectivity between fresh and marine water management systems and their species;
- Supporting regional water and marine environmental policies and S2S objectives by integrating these into other policy areas at the national and regional level.

Swedish efforts to reduce marine pollution

SUSTAINABLE DEVELOPMENT GOALS, TARGET 14.1:

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Executive Summary

- Success factors for reducing marine pollution include strong political will, public awareness and a robust regulatory framework.
- Systematic environmental monitoring is an essential foundation for efficient, sustainable pollution management.
- Nutrient losses are resource losses. Efficient, targeted fertilizer use is both economically and environmentally beneficial.
- Sustainable and effective management of solid waste and wastewater benefits human health and contributes towards protection of the environment.
- Plastic pollution remains a significant and complex problem requiring improvements in production, transportation, use and waste management to minimize inputs to the environment. Principle challenges include preventing new inputs and addressing legacy pollution
- The principles of the Swedish environmental code provide a powerful basis for sustainable environmental use.
- National governments need to take active responsibility for remediation of sites where the 'polluter pays' principle cannot be implemented.
- Regional cooperation shares costs and improves implementation in monitoring, analysis, research and mitigation of marine pollution.
- Good governance, in terms of the rule of law, citizen's rights of access to justice and information, public participation, accountability issues etc., are the cornerstones for good environmental performance and sustainable development. Therefore, integration of key aspects of SDG 16 is needed to fulfil SDG 14.

Swedish efforts to reduce marine pollution

Introduction

A long history of industrial and agricultural practices have caused extensive pollution problems in Sweden's freshwater and marine environments. Eutrophication problems arose first around urban centres during the 1930s due to poor sewage systems and worsened after agrarian advances in the 1950s. While nutrient loads to the sea peaked in the 1980s, impacts are still acute, with agriculture now the major activity contributing to nutrient pollution. Releases of hazardous substances from centuries of Swedish industrial activity cause severe effects in marine biota. Significant emission reductions in the last decades have allowed affected populations to recover, although contaminated soils and sediments remain as secondary pollution sources. Substantial run-off means that pollution problems in freshwater rapidly become pollution problems in the sea, making measures at source effective for protecting both freshwater and marine environments together. Pollutants such as medicinal residues and marine litter also need managing, with screening studies to identify new problems at an early stage. In essence, pollution prevention at source is safer, quicker and cheaper than mitigation and restoration.

Baltic brackish water ecosystems have become home to invasive species from several continents due to both poor ballast water management and deliberate introduction since at least the 1800s. Managing existing and preventing further establishment of invasive species is a major challenge. As maritime activities intensify, pollution from shipping needs to be controlled, both at sea and in port. The impact of maritime activities on the natural underwater soundscape is becoming a concern: noise from pile-driving, explosions or seismic exploration can involve rapid pressure changes that injure or scare off marine creatures. Noise from shipping interferes with animals' ability to communicate, hear predators or locate prey. Understanding of this problem is at an early stage but a lot of research is ongoing.

National efforts

Sweden was relatively early in addressing pollution problems. By the 1960s, eutrophication and pollution with hazardous substances were widespread and required a political response. The Swedish Environmental Protection Agency (SEPA) was founded in 1967 and the first environmental protection legislation in Sweden was introduced in 1969. It was amalgamated with several other environmental acts into the Environmental Code in 1999. This implements a strict precautionary approach, requiring users to demonstrate that activities are safe, with minimal impact, and that users have responsibility for restoration if they should cause environmental degradation. Activities are regulated through environmental courts, with government agencies responsible for protecting public interest. The Code requires use of the substitution principle, which means that one should as far as possible avoid the sale of or the use of such chemical products that may be considered to pose a risk to humans of the environment, if they can be replaced by products that are assumed to be less hazardous. This greatly reduces loads of harmful substances to water treatment works.

Since the 1960s, Sweden has had a well-developed system for monitoring the state of the marine environment. Long-term time-series of chemical contamination in water and biota have proved essential for decision-making and validation of measures taken, as well as for scientific research and raising public awareness. Industry and the regional administrations

fund and manage most regional and local monitoring while most data are public and freely available. During the 1970s, the Swedish state invested heavily in water treatment works. Industry invested in their own wastewater treatment. The separation of industrial waste from domestic sewage is vital to produce sewage sludge with lower levels of toxic substances. Sewage sludge re-use as fertilizer remains challenging without risking soil – and food – contamination. Further reductions in levels of pollutants are urgently needed and the Swedish Government is looking at possible ways to recover nutrients and energy from sludge while capturing hazardous substances. Sweden uses a variety of methods, from education and installments of new techniques for water treatment to financial incentives to bans, to encourage identification and use of safer alternatives to hazardous substances.

By the 1970s it was clear that fish, birds and marine mammals in Swedish seas were suffering from exposure to contaminants like mercury, PCBs and dioxins. With the adoption of the Environmental Act in 1969, emissions from industrial and other stationary plants were progressively regulated. Mercury, PCB and dioxin emissions from Swedish point sources are now more than 90 % lower than in the 1970s. Mercury and PCBs in products were also identified as significant sources of emissions to the marine environment and due to targeted regulations, mercury use has been close to eliminated, while almost 85 % of used PCBs have been phased out and destroyed. Many positive results have been observed in the environment, e.g. the recovery of the previously near extinct Swedish sea eagle population and reduced concentrations in other biota. The long history of industrial activities has also resulted in many thousands of contaminated soil and sediment sites. These provide a continuous source of contaminants to the environment. To address this, a national strategy and fund for remediation grants was adopted. The aim is to remediate the highest-risk sites (approximately 8 000) by 2050. Since 1999, Sweden's national environmental work has been coordinated through 16 environmental objectives plus a "the generational goal". These objectives, adopted by the Swedish Parliament, aim to solve the environmental challenges facing Sweden within a generation, without exporting the problems to other countries.

Marine pollution of plastic litter and microplastic has been recognized as an emerging issue that calls for immediate action at all levels. The past years, Sweden has carried out many activities to prevent the emergence and spread of plastic pollution, such as innovation projects to increase plastic recycling, implementing new rules and awareness raising campaigns on the use of plastic bags, and beach cleaning projects in coastal communities.

Regional efforts

Sweden makes extensive use of the Regional Seas Conventions (RSCs) HELCOM (Baltic Sea) and OSPAR (North Sea), both to drive work but also to share management costs. The conventions work through a process of assessing pressures and impacts through thematic assessments and then using recommendations, action plans and agreements to develop and ensure best practice. Coordinating national monitoring programmes and jointly assessing results provides data for recommendations and planning of measures and follows up their effectiveness. Recommendations cover a wide range of activities, from fish farming to plastics production to mercury use in dentistry. Significant agreements include a 1988 promise to reduce nutrient loads to the North Sea by 50 %, which led to measures to reduce nutrient losses at source, and an agreement to stop discharging mercury when producing PVC. Within the Baltic, advanced numerical models have been used to determine sustainable

nutrient loads, with countries agreeing to reduce their respective national loads to these levels.

Both HELCOM and OSPAR are updating their regional policies – HELCOM Baltic Sea Action Plan by 2021 and North-East Atlantic Environment Strategy by 2020 – with the aim of achieving good environmental status and sustainable use of resources in the marine regions. Both policies include ambitious objectives to combat eutrophication and prevent pollution.

The regional sea conventions provide a platform to rapidly address issues of regional relevance that have not yet been included in EU legislation and help contracting parties to approach to global actors where the EU is not represented. HELCOM has identified environmental investment priorities that have guided regional Swedish aid partnerships, for example with projects improving wastewater treatment. Another recent example is HELCOM contracting parties approaching the International Maritime Organisation (IMO) to agree on a ban of sewage discharge from passenger vessels in the Baltic Sea.

The European Union has stimulated better environmental management through directives ensuring food and water safety and more recently by establishing a level playing field in environmental standards across member states. Early directives include those protecting bathing- and drinking water from 1975. These have been developed and coordinated through the framework directives for surface, groundwater and marine waters, Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD).

Framework directives also regulate industrial releases to air and water and define legally binding Best Available Techniques. EU legislation also includes mechanisms for controlling invasive alien species. EU directives were incorporated into Swedish law when Sweden joined the European Union in 1995. Some measures required under the nitrates directive, for example, had already commenced through work in the RSCs but were strengthened by EU legislation. The EU-Commission is itself a signatory to the RSCs and recognizes them as a platform for regional coordination of the MSFD.

Analyses within the conventions are now targeted to assist member states in meeting European Union obligations. For example, HELCOM load assessments help in planning national Programmes of Measures for the Water Framework Directive, while thematic assessments contribute to national obligations under the MSFD. Activities under Programmes of Measures are part-financed through EU funds. Enforcement under both RSCs and EU is initially through examination of national reporting, to show progress towards agreed goals. Where progress is inadequate or rules poorly implemented, the EU has legal processes that can result in penalties for offending member states.

The EU Strategy for the Baltic Sea Region (EUSBSR) aims at reinforcing cooperation within the region to address common challenges, including the Baltic environment. It is a structure for regional cooperation, supporting the implementation of regional policy decisions (by e.g. HELCOM) by aligning priorities and existing funding. The BONUS research programme created by the EU and the HELCOM Contracting Parties who are also EU members, funds large, transnational research projects with a focus on economic and ecological development

in the region. It has produced results of immense value to regional marine pollution management.

The past three years, EU have made large efforts to strengthen the legislation on plastics with the overarching goal to reduce its negative effects on the environment, including the emergence and spread of plastic litter and microplastics. Sweden has been a driving force to maintain a high level of ambition and achieve a strong EU legislation on single use plastics, including fishing related litter, plastic packaging and microplastics in consumer products.

Sweden is also active within the Arctic Council and the Barents Euro-Arctic Council, focusing e.g. on identification and mitigation of pollution hot spots. The Convention on Long-range Transboundary Air Pollution (CLRTAP) and its Protocols on Heavy Metals and Persistent Organic Pollutants (POPs) as well as the Gothenburg Protocol are of major importance to monitor and reduce atmospheric deposition of contaminants and to abate eutrophication in Sweden and globally. Sweden currently holds the chair of CLRTAP.

International efforts

Sweden contributes actively to and drives the development of several international conventions and cooperation related to chemicals and hazardous substances. For example, Sweden acknowledges the Stockholm Convention on POPs as a central tool in pursuing the objective of a non-toxic environment and is fully committed to its effective implementation and further development, including necessary financial commitments to assist developing countries and countries with economies in transition. Sweden also actively supports the development of the Minamata Convention on Mercury and takes an active part in it. In July 2018 Sweden and Uruguay jointly established The High Ambition Alliance on chemicals and waste, a platform for dialogue and solution-oriented cooperation. The objective is to enhance awareness, ensure commitments and promote ambitious objectives for a sound management of chemicals and waste action at all levels.

Sweden is active in the development and implementations of the Basel convention, where improved management and prevention of plastic waste is currently a key issue. Sweden is also participating in activities to combat plastic pollution under the UN Environmental Program (UNEP). Taking active part in the expert group on marine litter and microplastics, Sweden strives together with other EU member states to reach a new global framework for plastics and carry out activities on nudging as a policy instrument to reduce plastic littering.

In addition, Sweden is engaged in multiple bilateral cooperation to develop effective environmental governance, including prevention and control of industrial pollution from hazardous substances and plastic, implementation of Best Available Technology, and waste and chemicals management. Sweden has a broad aid programme promoting sustainable management of marine resources particularly in eastern Africa and Southeast Asia.

Interaction and links to other management and research areas

- Research indicates that fisheries affect eutrophication symptoms: removal of predator fish leads to an excess of planktivores that in turn overconsume zooplankton and grazers, leading to increases in blooms of both phytoplankton and filamentous seaweed. In Swedish waters, predatory fish such as cod, pike and perch

have declined through overfishing and habitat loss. Nutrient loads, fisheries and coastal and marine habitats need integrated, coordinated management.

- Increased extreme run-off events resulting from climate change flush pollutants off the land, including from towns and cities. Green infrastructure, in the form of water retention measures such as wetlands, swales and tree pits delay run-off, reduce maximum flows (and thus erosion) and reduce the risk of untreated sewage overflow into the water treatment network. These measures are nutrient retention approaches that also reduce flows of litter and hazardous substances.
- Effective sewage treatment is vital to protect the marine environment, but also to achieve SDG Goals 3, 6, and 11, at the very least.
- Marine plants are effective carbon sinks, but excess nutrient and pollutant loads damage seagrasses and perennial macroalgae.
- Increasing atmospheric carbon dioxide is driving global ocean acidification, but sulphur oxides (SO_x) and nitrogen oxides (NO_x) are also acidifying. The use of scrubbers on ships and in coal-fired power stations are effective ways to reduce emissions of SO_x to the atmosphere, but scrubber wash water is often heavily polluted with heavy metals, PAH:s and eutrophying substances (NO_x), which are discharged directly back into the sea. The FORMAS project SHIpH (Commercial shipping as a source of acidification in the Baltic Sea) concluded that the acidifying effects from shipping in the Baltic Sea will be more pronounced with widespread use of scrubber technology due to the direct transfer of acid to the sea. However, the main concern regarding scrubbers is the potential effect of the cocktail of contaminants in combination with acidifying and eutrophying substances, especially in heavily trafficked, semi-enclosed areas such as estuaries.

Challenges and Gaps

- The impact of Swedish consumption and production on environment and health in other countries is growing. Action is needed to reduce the Swedish global environmental footprint.
- There is need for a comprehensive global framework on plastics that address the issue of marine litter and microplastics at the national, regional and global level.
- Underwater noise is an international issue since sound travels long distances under water. Measures to reduce noise need to be agreed in regional sea conventions and at the IMO in order make them effective.
- Over-consumption and food waste are double eutrophication problems: excessive food production has an environmental cost, but there is also an additional cost in treating an excessive amount of human waste.

- In Sweden, agricultural measures are a mix of obligatory and voluntary actions, often financed through grants to farmers. Ensuring that the right measure is implemented in the right place is particularly challenging, especially at a local level.
- Research questions remain: variable soil types and data shortages make modelling nutrient flows and retention problematic at the national scale, despite advances in computer power. Despite this, nutrient modelling is arguably more advanced than modelling the transport and fate of organic pollutants and microplastics. The description of ecosystem components in marine environment models is still rudimentary.
- Consumer products contain a multitude of chemicals that can reach the marine environment through diffuse emission and transport via e.g. sewage treatment plants. The knowledge and regulation of chemicals in products needs to be improved.
- The global production of chemical increases rapidly. Changes in global production, in combination with the increased internet trade, result in less knowledge and possibilities to control the import to Sweden of hazardous substances in consumer products.
- To reduce the amount of hazardous substances in society, companies and the public sector need to be encouraged to replace hazardous substances with less dangerous ones (substitution) and to develop completely new non-toxic solutions (innovation). Examples of the latter are e.g. different types of boat bottom washers instead of biocide-based boat bottom paints.
- The protection of shallow bays needs to increase. They are the main nurseries of the seas, i.e. where marine organisms live during their developmental stages, and thus are particularly sensitive to human activity and disturbances. High concentrations of hazardous substances are measured in such environments.
- The fishing industry in Sweden is threatened by poor catches. In addition, parts of the catch may not be sold or exported due to the content of hazardous substances (e.g. dioxin), which means economic loss and loss of jobs for the fish industry. Add to this the health problems that can arise for those who eat the contaminated fish.
- Implementation of SDG 14 (and other SDGs) in Sweden requires a translation of the SDG targets to national policies and objectives. Stronger coherence between SDG targets and national targets (e.g. Environmental Objectives, the Generational goal, etc) is needed.

Swedish efforts to reduce marine litter pollution

SUSTAINABLE DEVELOPMENT GOALS, TARGET 14.1:

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Executive summary

- Marine litter is a growing global problem, causing negative effects on the marine environment and socio-economic costs to our society as a whole.
- Litter enters the ocean from both land- and sea-based sources. Rivers can act as important routes for carrying litter to the ocean, even from sources far from the coast. In addition, currents and winds can transport buoyant litter, such as plastics, long distances.
- Plastic items make up the largest fraction of marine litter. Plastics can be very durable in the marine environment. They can therefore remain for centuries and accumulate if not cleaned up. Plastic items may also break down into tiny pieces, so-called microplastics.
- The loss of waste and material, especially plastic, is a loss in resources. Efficient use of material and waste is both economically and environmentally beneficial.
- Marine litter needs to be treated as a cross-sectoral and transboundary issue, where strong measures need to be implemented from the local to the global level. Success factors for reducing marine litter pollution include strong political will and a robust regulatory framework. It also includes changed production and consumption patterns, public awareness and changes in behaviour, adequate waste management both on land and at sea, as well as appropriate wastewater and storm water systems.
- Systematic monitoring is an essential foundation for efficient marine pollution management.
- There are several knowledge gaps, but we know enough about the effects on our environment and society in order to take precaution and act.
- Via regional cooperation, we can coordinate and share costs of monitoring, analysis, research and mitigation of marine litter pollution.

- Most of the sustainable development goals (SDGs) are interlinked with one another. SDG 12, Responsible consumption and production, plays an especially vital role in fulfilling SDG 14.

Swedish efforts to reduce marine litter pollution

Introduction

Marine litter is a global environmental problem that is growing, causing negative effects on marine life and the provision of ecosystem services as well as on socio-economic costs to our society as a whole. Marine litter originates from a variety of sources and enters the ocean from activities both on land and at sea, such as from commercial and recreational shipping. In addition, rivers can act as important routes for carrying litter from sources that are far from the coast. In Sweden, marine litter is an environmental problem, especially along the northern parts of the Swedish west coast where prevailing currents and winds drive up to 8,000 cubic metres of litter annually onto the shore. This situation makes the area one of the most polluted areas of marine litter in Europe.

Awareness of marine litter has increased. Several policy instruments and legislations are in place for handling the main sources of marine litter, both at national and international levels. However, the problem is still growing globally. This indicates that current policy instruments might be inefficient or need to be complemented. Marine litter is a cross-sectoral problem, and tackling it requires changes in behaviour and production and consumption patterns, technical solutions and innovations, adequate waste management both on land and at sea, and appropriate wastewater and storm water systems. Marine litter is also a transboundary problem that stresses the need of working across different scales, from the local to the global level.

Plastics make up the largest fraction of marine litter. The production and use of plastic material has drastically increased since the 1950s. The fact that plastic is often lightweight and durable makes it useful to society, but it is a significant threat to the marine environment. It is estimated that several million tons of plastic ends up in the oceans every year. Since the majority of plastic materials takes a very long time to degrade (from decades to even centuries), plastic litter in the marine environment is very persistent and accumulates unless cleaned up.

Plastic items can drift large distances and end up far away from their original source. The fact that marine animals can ingest plastic litter and become entangled in it – with starvation and drowning as a consequence – is one of the main environmental issues of marine litter. Plastic items will eventually break down into smaller pieces, so-called microplastics which are particles smaller than 5 mm. As these particles are impossible to clean up, it is expected that their concentrations will increase in the future. Microplastics are found in basically all studied marine environments and are ingested by a broad range of marine organisms. Experiments indicate that microplastics may have adverse effects, at least when ingested in high concentrations. Nanoplastics, breakdown products of larger plastics, can cross

biological barriers (like gut lining) and be taken up into organisms, thereafter causing harm, but we know almost nothing about their presence or prevalence in the marine environment.

Since plastic materials sometimes contain toxic substances or even accumulate hazardous substances from the marine environment, another issue is the risk of toxic substances entering the food web through this source. While this exposure route is thought to be of limited importance compared to uptake of toxic chemicals via e.g. the food web and trophic transfer, the extensive use of plastic materials and associated chemicals adds to the ubiquitous presence of these substances in the environment. Plastics may also act as vectors for movement of invasive species, carrying invertebrate animals, eggs, and microbes into new areas. Plastic-specific biofilms can form, and may be enriched with several species of pathogenic bacteria, including *Vibrio* sp.

Marine litter is now recognised as a serious environmental issue, and our ambition should be working toward close-to-zero litter in the marine environment. Work to establish realistic baselines and threshold values has been ongoing, and will need to be specific for different fractions of litter, environmental niches, and species. Despite the knowledge gaps, we know enough about the effects on our environment and society in order to take precaution and act to prevent deterioration of the marine environment.

National efforts

Awareness of marine litter has increased in the past thirty years, both in Sweden and worldwide. The Swedish foundations Keep Sweden Tidy and the West Coast Foundation together organized the Year of Clean Beaches in 1987–88. Keep Sweden Tidy works nationally and internationally with public information and active cleaning efforts. In 2017, Keep Sweden Tidy established the network Keep the Oceans Tidy, which is a proactive and voluntary network to combat man-made litter. The membership network is open to all actors in trade, industry, academic, civil society and public sectors. The West Coast Foundation continued for several years to coordinate the municipalities' cleaning efforts along the coast. Since 2009, municipalities along the northern part of Sweden's west coast have worked together in various projects to make their cleaning efforts more effective, and to highlight the serious amount of marine litter floating ashore on their coastline. Furthermore, Keep Sweden Tidy helps mobilize volunteers across the Nordic region to clean beaches on the Nordic Coastal Cleanup day every year. The Swedish Agency for Marine and Water Management (SwAM) supports several such projects with the aim of reducing and preventing marine litter, including educational programs aimed to increase Ocean Literacy. SwAM is currently evaluating demands on reducing negative impacts of fishing gear in the marine environment. To combat ghost fishing and marine litter in the Nordics, the network Clean Nordic Oceans was established to exchange knowledge and experience of methods and measures that can reduce the risk of ghost fishing and marine. All Nordic countries have participated in the network and SwAM partook as one of three project partners.

Sweden's waste management is based on high levels of recycling and reuse, with incineration as the final step rather than landfill. This form of energy recycling is considered in waste hierarchy and reduces the risk of large quantities of litter being lost to water and air. The private sector has increased plastic material recycling capacities in Sweden, in line

with Europe's focus on a circular economy. Economic incentives are used to encourage use of more readily recyclable materials, reducing reliance on new production of raw plastic. Strict requirements for sewage treatment result in improved litter removal. For example, Europe's largest disk filter installation, in Gothenburg, Sweden, removes particles as small as ~0.3 mm, although removal at source would be even better. New investments will reduce the release of microplastics into the marine environment via storm water.

In Sweden, several policy instruments and legislations are in place for handling the main sources of marine litter. Nevertheless, the problem is growing globally. This affects Sweden and indicates that current national policy instruments need to be complemented with international efforts. Sweden therefore prioritises efforts against marine litter within two of the Regional Sea Conventions – OSPAR for the North-East Atlantic and HELCOM for the Baltic Sea – as well as within the EU's Marine Strategy Framework Directive (MSFD). The MSFD was incorporated into Swedish law in 2010, which means that Sweden now partially has a monitoring program for marine litter (which includes litter on the beach and seabed but excludes microlitter monitoring) and a program of measure (PoM) for marine litter. The PoM includes five measures directed toward the reduction of abandoned, lost, and discarded fishing gear; public awareness campaigns; coastal beach cleaning in particularly affected areas; and the inclusion of marine litter into national and local plans on waste prevention and management.

Ministry of the Environment and Energy proposed national measures for restricting the occurrence of micro-plastics in cosmetic products. The Swedish Chemicals Agency investigated the feasibility of this proposed a new regulation banning all such products on the market that contain plastic particles for cleansing, scrubbing, and polishing, and are intended to be removed or spat out after having been used in hair or on skin, mucous membranes, or teeth, which would in effect reduce the discharge of plastic particles in wastewater. In line with an EU directive, Sweden has decided to reduce the use of plastic bags from a maximum of 90 bags per person per year by 2020 down to 40 before 2026. Fees are already collected by many retailers, and a tax on bags (0.3 SEK/bag) will be implemented to further reduce usage.

Regional efforts

At the EU level, a wide range of policies and directives addresses the source and impact of marine litter. This includes legislation on waste management, urban wastewater, and pollution from ships. The MSFD is the dedicated binding legal instrument for assessing, monitoring, and setting targets to reach good environmental status with regard to marine litter. The MSFD is implemented nationally and coordinated regionally. The EU itself is a signatory to the Regional Sea Conventions and recognises them as the platform for regional coordination. Thus, strong synergies exist between the MSFD and the Regional Action Plans on Marine Litter, mentioned below. In addition, the EU Plastic Strategy may play an important role in preventing marine litter. In addition, the Single Use Plastic (SUP) directive was decided as a part of the EU Plastics Strategy in May 2019.

The SUP directive aims to tackle marine litter by phasing out single-use plastic items that are most frequently found on beaches, as well as lost and abandoned fishing gear. Furthermore, the SUP directive establishes economic incentives to reduce consumption and transition to

reusable systems, high collection rates and extended producer responsibility schemes (EPR). The SUP Directive also addresses the need for information to consumers, which is imposed on both producers and the nations. Sweden makes extensive use of HELCOM and OSPAR to drive work and share management costs. The conventions work through a process of assessing pressures and impacts through thematic assessments and using recommendations, action plans, and agreements to develop and ensure best practices. One example is the OSPAR recommendation on “fishing for litter” initiatives. Yet another is the HELCOM recommendation on the no-special-fee system for ship-generated waste and marine litter caught in fishing nets. OSPAR and HELCOM developed, in 2014 and 2015 respectively, Regional Action Plans on Marine Litter (RAP ML) with member countries sharing responsibility for actions, and mitigation work often being completed by nationally funded NGOs. The action plans address both land- and sea-based sources and are divided into regional and voluntarily national actions. The regional actions address problems requiring cross-scale reinforcement and collective action by contracting parties, with focus on fisheries related actions, ship generated waste, land based waste management, education and outreach, cleaning activities and behavioural actions, and more sustainable use and design of products and packaging. The voluntary national actions primarily address problems of national concern. The RAP ML also provide a platform to address issues of regional relevance that have not yet been included in EU legislation, and even help contracting parties to approach global actors where the EU is not represented.

Sweden is co-lead and supports several regional actions within the RAP ML. These include actions to prevent and reduce marine litter within the fishing sector, to prevent and reducing litter, including microlitter, from entering the marine environment via wastewater and storm water, to coordinate action regarding ship generated waste, and phase out microplastics in personal care products. In line with our regional work, Sweden has supported two EU projects: MARELITT Baltic (2016-2018) aimed to reduce the impact of derelict fishing gear in the Baltic Sea, and BLASTIC (2016-2018) aimed to reduce plastic waste and, consequentially, the inflow of hazardous substances into the Baltic Sea by mapping and monitoring the amounts of litter in the aquatic environment. In 2019, Keep Sweden Tidy was funded by the Swedish Environmental Protection Agency to digitize the tool that was developed in BLASTIC. At the same time, the tool was adapted for Swedish conditions to become more relevant to Swedish municipalities. Marine litter issues exist on the agendas of many actors, and various processes of relevance for OSPAR’s and HELCOM’s Regional Action Plans on Marine Litter are ongoing. OSPAR and HELCOM have working groups committed to developing monitoring programs and indicators for marine litter. To their help, they have a dedicated subgroup at the EU level working on these issues in order to support member states in reaching good environmental status for marine litter. In addition, the EU platform JPI Oceans ran four research projects investigating the impact of plastic particles on the marine environment, and continues to support cutting-edge research on the identification and monitoring of micro- and nanoplastics. JPI Oceans is supported by Sweden and nine other countries. Sweden is also active within the Arctic Council which recently decided to more actively engage in the issue of marine litter.

Interaction and links to other analysis areas

Large amounts of marine litter, as well as microparticles and litter ingested by marine animals, act as a disturbance on the ecosystem and can have a negative impact on

ecosystem services like food web dynamics, maintenance of biodiversity, habitats, and resilience. Use of plastics (from production to use to waste disposal) is also intricately connected to pollution and climate change. Awareness of marine litter as an environmental problem works as a driving force toward better waste management and resource efficiency. This, in turn, could have a positive impact on our climate. It also draws more attention to the need of adequate wastewater and storm water treatment which links to the reduction of other marine pollutants such as nutrients and hazardous substances. Classical nutrient retention approaches, in the form of water retention measures, reduce the risk of untreated sewage overflow by delaying the run-off from land and reducing the maximum flow. These measures also reduce flows of litter and hazardous substances to the marine environment.

Challenges and Gaps

- Marine litter is a cross-sectoral and transboundary problem in which the resolution of the problem requires the involvement of a variety of actors from the local level all the way to the global scale.
- The amount and composition of marine litter varies greatly from one region to another and depends on a number of factors. Thus, even if much is to be won by sharing experiences and knowledge between different regions, one must adapt the measures to fit one's own context.
- Marine litter is recognised as a serious environmental issue and our ambition should be working toward close-to-zero litter in the marine environment. Even so, there is a need to launch realistic baselines and threshold values.
- Knowledge gaps exist. For example, the environmental effect of microplastics has just begun to be studied and our picture of where marine litter accumulates in the marine environment is fragmentary. Monitoring is therefore essential, even though it does not give us the whole picture. Despite the knowledge gaps, we do know enough about the effects of marine litter on our environment and society in order to take precaution and act.
- As the new SUP Directive is to be implemented nationally, it will be crucial to find effective implementation strategies, relevant targets and baselines and ensuring enforcement and monitoring programs to assess the impact of those measures. In addition, it is important that all awareness raising actions is implemented as long-term and recurring measures to have an effect long term.
- Bioplastics (plastic particles that are either bio-based, biodegradable, or both) are sometimes proposed as a way to mitigate marine plastic litter. However, the term 'biodegradable' does not imply that bioplastic materials are easily degradable in the marine environment. Misleading communication regarding plastics that is termed as biodegradable could result in a more relaxed attitude towards littering. Current scientific studies show that degradation of bioplastics does not occur to a great extent in the marine environment and the potential harmful effects on organisms are understudied. More studies are needed before advocating bioplastics or biodegradable plastics as a solution to marine litter, and considerable attention must

focus on end-of-life management of these products. It is important that we continue to focus on minimising the use of single-use plastics and plastic bags, and decreasing marine litter regardless of origin.

- Microlitter derives from a variety of sources implying that we need to think in new terms when technical solutions, materials, and infrastructure are developed.
- Microfibers from synthetic materials are found ubiquitously in the marine environment, but study of their fate and impacts is in its infancy, and the relative importance of these contaminants compared to fibres of natural materials is unknown.
- Another emerging class of marine litter is engineered nanoparticles which are used in a wide array of products, from cosmetics and biomedicine to agriculture. Laboratory studies indicate that nanoparticles can cross biological barriers to enter into organisms, and have harmful effects in microalgae, invertebrates and fish. More research on the effects on humans as well as the environment is needed, and precautions should be used when applying nanoparticles in applications from which they might be spread to the environment.

Swedish efforts concerning ecosystem-based management

SUSTAINABLE DEVELOPMENT GOALS

TARGET 14.2:

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

TARGET 14.5:

By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

EXECUTIVE SUMMARY

- Sustainable management and protection of marine and coastal ecosystems depends strongly on the implementation of all targets of SDG14, as well as the SDGs 2 (zero hunger), 3 (good health and well-being), 6 (clean water and sanitation), 8 (decent work and economic growth), 11 (sustainable cities and communities), 12 (sustainable consumption and production patterns), 13 (climate action) and 17 (partnership for goals).
- The governance and policy framework that can contribute to reaching the ocean related SDGs stretches from international, regional (European and marine regions), national, to sub-national level.
- Sweden works actively towards implementing its global, regional and national commitments to manage natural resources and develop the ecosystem-based approach, realising the need to sufficiently support those countries with less means to mitigate and adapt to environmental challenges.
- Climate change is projected to cause rise in sea levels, ocean warming and acidification, leading to shifts in the distribution of species and habitats. These changes are constricting the living environments of many species, increasing extinction risks, and triggering substantial changes in marine food webs. Diverse ecosystems are more resilient and predicated to better adapt to climate changes underscoring the importance to protect and effectively manage marine ecosystems to ensure future uses and ecosystem services.
- Recognising and understanding the connectedness of terrestrial, freshwater and marine ecosystems, including links between biological, social and economic systems,

is a critical prerequisite to achieve an ecosystem-based management and the sustainable development goals.

- Marine systems are characterised by high complexity as well as high connectivity. As a consequence mapping and monitoring of ocean processes, flora and fauna is often associated with technical or practical difficulties. Management and conservation further needs to understand and deal with cumulative pressures and human impacts acting at different temporal and spatial scales. Given these challenges and sources of uncertainty, there is a clear need to develop scientific resources that can support government decision makers in the processes towards an ecosystem-based management.
- There is a continued need to increase national and international efforts in research and ecosystem-based management to achieve SDG 14.2, support resilient oceans and coastal ecosystems, and secure the long-term provision of ecosystem services.

Swedish efforts concerning ecosystem-based management

Introduction

Marine and coastal ecosystems are highly multifaceted due to many interacting biological and physical processes. Failure to sustainably manage these systems and the human activities impacting on them is causing major ecosystem shifts across the globe. Climate change alone is expected to cause substantial biodiversity loss, which will reduce the resilience of ecosystems and threaten the provision of key ecosystem services, but is acting concurrently with and being reinforced by impacts from multiple other human pressures. Human population growth and growing competition for natural resources create additional pressures. At the same time healthy coastal and marine ecosystems are crucial for poverty reduction, food security and economic development worldwide.

Ecosystem-based management (EBM) is an approach to facilitate the integrated management of land, water and living resources, that recognizes humans and associated economic and social systems as parts of the ecosystem. To be adaptive, make use of scientific knowledge, and follow changes through monitoring are also key principles of EBM. The aim is to promote conservation and secure the long-term provision of ecosystem services and benefits from natural resources, encompassing ecological, social and economic aspects.

Challenges to the use of EBM includes the many governance institutions and management authorities involved and the need for interdisciplinary studies and advice from the multiple scientific disciplines that address the marine and socio-ecological system. Maritime Spatial Planning (MSP) is an example of a management approach that can support the implementation of EBM. Marine Protected Areas and other spatial restrictions to human activities can promote the recovery of deteriorated ecosystems and sustain resilience in terms of genetic and biological diversity.

National efforts

One government agency manages fisheries, water and marine issues

In Sweden, the Swedish Agency for Marine and Water Management (SwAM) collectively manages fisheries, water and marine issues. The presence of all of these issues under one roof greatly facilitates the development and implementation of an ecosystem-based management.

Sweden applies the ecosystem-based approach in marine spatial planning (MSP)

Sweden has developed a spatial assessment tool (Symphony) that facilitates direct consideration of cumulative environmental impacts from both land and sea-based human activities in the MSP process. Symphony works with multiple data sets of key ecosystem components and anthropogenic stressors to identify ecological indicators required to reach Good Environmental Status (GES). The transparent method ensures sectorial integration and a source-to-sea perspective in MSP. Sweden collaborates with several European partners and the USA to further develop and implement Symphony.

Sweden aims for efficient and well-designed monitoring

Implementing EU directives linked to the marine environment, such as the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD), Sweden is to define and assess the environmental status of its waters, decide if Good Environmental Status (GES) is or will be achieved, establish programmes of measures if needed and keep a process running that will allow stakeholder to contribute. Policies and monitoring programmes have to be continuously adapted, a key to reach the SDGs and other environmental targets.

Sweden emphasises the importance of ecosystem services and green infrastructure in ocean management

The central value of marine ecosystem services and biodiversity is integrated in numerous Swedish policy documents, practices and decisions. These include environmental accounting, business models, and environmental impact assessments. Comprehensive marine habitat mapping in Sweden identifies ecological connections and biodiversity hotspots that underpin marine green infrastructure. This feeds into marine management, MPAs and MSP through a variety of local, regional and national programmes. MOSAIC, for example, is a comprehensive method for assessing environmental status and ecological value, in support of marine conservation and the safeguarding of marine green infrastructure.

Sweden is aiming to protect 30 per cent of the ocean by 2030

Marine protected areas (MPAs) can be a powerful tool to contribute to a Good Environmental Status of the world's oceans. By designating new MPAs Sweden reached the commitment of 10 % MPAs already at the end of 2016. However, more work remains to also meet the goals concerning connectivity and representativity. In the beginning of 2020 Sweden signed up to an international initiative to protect 30 per cent of the oceans by 2030, as considered in the development of a post-2020 global biodiversity framework under the Convention on Biological Diversity.

Preserving, protecting and restoring over 300 marine areas with associated fishing conservation measures to promote fish stock recovery

Sweden has introduced multiple measures to protect and restore degraded marine habitats and populations. For example: bottom-trawling has been banned within 3-4 nm of the Swedish coastline, and 300 areas are closed for fishing as they have been defined as important fish spawning and migration areas where only handheld fishing is allowed.

A Swedish programme of measures to address the MSFD was finalised in 2016. These measures incorporate the ecosystem-based approach by promoting biodiversity, for example protecting eelgrass and mussel-beds which play key roles in supporting coastal fauna and flora. Work is underway to develop a comprehensive database and toolkit for the restoration of coastal habitats, including methodologies for the restoration of eelgrass beds, bladder wrack, mussel-beds, and deep water corals, and a framework for assessing damages and restoration needs in relation to losses to biodiversity and ecosystem services.

A strategy for ecosystem-based fisheries management (EBFM)

The purpose of EBFM is to make the use of marine and coastal waters ecologically, economically and socially sustainable by managing the fish and fisheries on both a society and ecosystem level. EBFM is supported by legislation and policy documents, both in Sweden and at EU level, and a strategic plan for EBFM has been developed by SwAM.

Regional efforts

Multilateral collaboration enables regional agreements and holistic environmental assessment

Sweden is a signatory to several regional conventions and collaborates in associated commissions such as HELCOM and OSPAR. These two commissions are important in the promotion of a holistic marine policy in the Baltic Sea and the North East Atlantic. Sweden contributes regularly to the regional collection and synthesis of data and common assessment methods. In 2017 the HELCOM countries agreed to coordinate the regional implementation of ocean-related SDGs in the Baltic Sea using HELCOM as a platform. Both HELCOM and OSPAR are updating their regional policies – HELCOM Baltic Sea Action Plan by 2021 and North-East Atlantic Environment Strategy by 2020 – with the aim of achieving good environmental status and sustainable use of resources in the marine regions. Both policies are founded on the ecosystem approach.

The EU's Common Fisheries Policy (CFP) aims to implement ecosystem-based fisheries management

Sweden, as a member of the EU, has been involved in developing the Common Fisheries Policy (CFP), which includes using an ecosystem-based fisheries management approach. One objective of the CFP is to set TACs leading to all stocks being managed above MSY levels. In addition, the CFP provides the tools for conservation measures necessary for compliance with obligations under Union environmental legislation. Sweden, together with Denmark and Germany, has developed a joint recommendation for fisheries conservation measures in Bratten, a marine protected area in the Skagerrak (North Sea). The conservation measures include no-take zones, and the mandatory use of an Automatic Identification System (AIS) and a Vessel Monitoring System (VMS) for compliance purposes. Sweden continues to work within relevant parts of the CFP to implement necessary conservation measures in marine protected areas using an ecosystem based approach.

Sweden engages in regional research for science-based management of ocean resources

Sweden is active in several regional ocean research programmes, including the EU research platform Joint Programming Initiative, Healthy and Productive Seas and Oceans (JPI Oceans), the Joint Baltic Sea research and development programme (BONUS) and the development of its tentative successor BANOS which is intended to cover research to support management of both the Baltic Sea and North Sea. Sweden and France are leading a JPI-Oceans initiative to establish a research network and agenda for ecosystem services-based assessments for MSP and MSFD. Within the Nordic Council of Ministers working group HAV, several activities and projects have developed tool-kits and best practices for science-based management. Sweden is a member of the International Council for the Exploration of the Sea (ICES). Sweden participates in many ICES working groups addressing ecosystem-based management. Through our engagement in ICES, we are involved in the work of North Pacific Marine Science Organisation (PICES) and the Northern Atlantic Alliance.

Sweden plays a progressive role for environmental protection within the International Maritime Organization (IMO)

Recent achievements that will substantially reduce the eutrophication and acidification of regional seas include the Ballast Water Management Convention, the Sulphur Emission Control Area (SECA), the Nitrogen Emission Control Area (NECA) and the International Code for Ships Operating in Polar Waters (IMO Polar Code).

Monitoring fisheries to support healthy ecosystems

The EU Data Collection Framework (DCF) provides a common framework for the collection, management, and sharing of fisheries data. Annual surveys and stock assessment within The EU Data Collection Framework (DCF) form the basis for scientific advice on the CFP, which aims to achieve fisheries sustainability.

Collaboration in various cross-border planning initiatives

Sweden is supporting coordination of MPA processes and marine spatial planning (MSP) through the development of a methodology for producing maps in order to increase the understanding of biodiversity and protection needed in the Baltic Sea. EU Baltic SCOPE, Pan Baltic SCOPE and North SEE are some examples of cross-border planning initiatives.

Collaboration between intergovernmental organisations should be strengthened

Collaboration among sectorial bodies responsible for fisheries and for biodiversity is of key importance to achieve an ecosystem approach to fisheries management. One such example is the collaboration between OSPAR and NEAFC (Northeast Atlantic Fisheries Commission).

International efforts

Sweden strives to increase regional and international collaboration

In addition to the Regional Seas cooperation, such as OSPAR and HELCOM, Sweden participates actively in international fora including FAO, OECD, UNEP, UNDP, UNCLOS, CBD, CITES, the Arctic Council, CCAMLR, IMO, and Regional Fisheries Bodies.

Sweden supports multilateral cooperation on coastal ecosystems

Sweden's long-term commitment to international ecosystem-based management includes: 1) programmes in Asia and the Pacific - Mangroves for the Future (Southeast Asia) and Southeast Asian Fisheries Development Center, 2) research cooperation in Tanzania and Mozambique, 3) the Western Indian Ocean Marine Science Association, and 4) several marine regional programmes in Africa to support the Nairobi and Abidjan regional seas conventions.

The Source-to-Sea Platform

The Source-to-Sea Management Platform (S2S) is a Swedish initiative with diverse international stakeholder participation. S2S encourages global collaborations among freshwater, coastal and marine experts in land - sea interconnections, and provides on-demand knowledge, support, and guidance for policy development and implementation.

UNCLOS increases protection of the high seas

Sweden is playing an active part in negotiating an Agreement on Biodiversity Beyond Areas of National Jurisdiction (BBNJ) to protect biodiversity on the high seas.

Sweden engages in bilateral marine environmental, climate, and fisheries collaborations

Sweden has developed multiple partnerships with many nations, such as Brazil, China, Russia, South Africa and Vietnam to increase capacity-building and knowledge-exchange to better understand how to govern for resilient marine ecosystems and rights-based fishing practices.

The Arctic – Sweden engages in ecosystem-based management, marine protected areas and marine litter

Since 2016 Sweden has an environmental policy for the Arctic, with emphasis on greater protection of biodiversity and ecosystems on land and at sea, enhanced climate efforts and sustainable use of resources. Sweden's commitments in the Arctic council include projects to further develop area-based conservation and ecological connectivity (MPAs), co-leading in the development of a Regional Action plan on Marine litter in the Arctic, and monitoring and assessing acidification in the Arctic. Sweden also participates in several Arctic Council expert groups, and annually conducts collaborative research in the region with other countries.

Swedish engagement in Antarctica

Sweden conducts collaborative research in the Antarctic region. Sweden is also engaged in international organisations working with coordinating international scientific research in the region, e.g. SCAR (Scientific Committee on Antarctic Research) and COMNAP (Council of Managers of National Antarctic Programs).

Swedish engagement in the UN Decade of Ocean Science for Sustainable Development

UN has launched the initiative Decade of Ocean Science for Sustainable Development (2021-2030). The aim is to create a common ocean science framework that can support countries in achieving the UN SDGs and turn the scientific knowledge and understanding into effective actions to support a sustainable development. Contribution to EBM is one of the highlighted outcomes of the Decade. In this context, HELCOM committed in 2020 to organize a workshop on ecosystem-based management in support of the UN Decade of Ocean Science. On commission from the government, Formas (Swedish research council for Sustainable

Development) is responsible to develop the plan for Sweden's contribution to the UN Decade.

CHALLENGES AND GAPS

- Given the high complexity of marine and coastal ecosystems, demands associated with monitoring and observation, and our challenges in improving environmental status as well as understanding cumulative impacts, there is a clear need to develop transparent science-based processes that can reduce prevailing uncertainties and assist governments and other decision makers in dealing with management options under uncertainty, forwarding ecosystem-based management.
- The multiple governance levels and the many policies that influence the state of the seas necessitates collaboration and coordination for achieving the agreed environmental goals; between countries and between national authorities, organizations and institutions.
- The failure of some nations to ratify UNCLOS and other internationally binding agreements, threatens protection of the high seas (i.e. 64% of the ocean's surface).
- Habitat degradation and climate change are global threats to conservation and the long-term provision of natural resources, and are further exacerbated by insufficient implementation of international legal instruments targeting unsustainable fishing and pollution.
- Current limitations to the valuation of marine resources and ecosystem services restrict capacity to manage marine ecosystems from a holistic perspective. This gap challenges, for example, the quality of maritime spatial planning and the designation of marine protected areas in relation to key aspects under the ecosystem approach, such as ecological representativity, connectivity and functionality.
- Knowledge on the effectiveness of management measures, including spatial measures, is often limited and thereby also the potential to evaluate if management actions are sufficient. Finding synergies across mitigation measures could contribute to mitigation of several pressures and lessen the cumulative burden on the marine ecosystem.
- Practical implementation and management of marine protected areas is a challenge as some protected areas may include several restrictions whereas others are not associated with relevant regulations or monitoring. Further, the protected areas may not serve as intended if they are affected by external pressures acting at a larger scale than the designated area, such as climate change, ocean acidification, extraction of mobile species and pollution .

- It is important to apply an adaptive and ecosystem-based management approach to marine protected areas to ensure effective management plans.
- A lack of operational experience in how to understand the impacts of multiple pressures and successfully integrate cumulative impact assessments in marine policy limits our capacity to move from sectoral to holistic ocean management.
- There is insufficient transdisciplinary and cross-sectoral management practices to understand and sustainably manage marine and coastal ecosystems, including the ecosystem resilience, biodiversity, food web processes and the interconnectedness of ecological and socioeconomic dimensions.
- There is the need to closely establish collaborations with the work in progress by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and embrace the Nature's Contribution to People (NCP) conceptual framework for the valuation of ecosystems.

Swedish efforts to address ocean acidification, including links to climate change

SUSTAINABLE DEVELOPMENT GOALS, TARGET 14.3:

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

Executive summary

- Substantial emissions reductions in line with the Paris agreement will benefit the mitigation of both climate change and ocean acidification. The latter is a strong call for an upscaling of ambition in line with the Paris agreement and SDG 13.
- Specific adaptation options to ocean acidification are available but critically depend on the understanding of effects at the local scale. Other options aiming at reducing other environmental stressors can help to increase the resilience of ecosystems to ocean acidification (and vice versa). Implementation of marine protected areas and science-based ecosystem management can also contribute to an increase in ecosystem resilience. Adaptation is only feasible at the local scale and is not a long-term alternative to cutting CO₂-emissions.

There are good examples of enhanced scientific collaboration at the national, regional and international levels. Yet, there is a need for a more strategic approach to address pressing data and knowledge gaps such as monitoring at the relevant spatio-temporal scale, understanding of the cumulative impacts of multiple stressors, and the modulating role of ecology and evolution. This knowledge is critical for the development and successful implementation of effective and cost-efficient tools to manage and address ocean acidification.

Swedish efforts to address ocean acidification, including links to climate change

Introduction and challenges

The IPCC Climate Change 2014 Synthesis Report finds that since the beginning of the industrial era, oceanic uptake of CO₂ has resulted in acidification of the ocean. The average pH of ocean surface water has decreased by 0.1 units, corresponding to a 26 % increase in acidity, measured as hydrogen ion concentration. Earth System Models project a further global increase in ocean acidification for all RCP (representative concentration pathway) scenarios by the year 2100, with a slow recovery after mid-century under RCP2.6 (high

mitigation). There is high confidence that ocean acidification will increase for centuries if CO₂ emissions continue, and will strongly affect marine ecosystems.

Rising rates and magnitudes of warming and other changes in the climate and non-climate systems, accompanied by ocean acidification, increase the risk of severe, pervasive, and in some cases irreversible detrimental impacts. Some risks are particularly relevant for individual regions, while others are global. The overall risks of future global change impacts can be reduced by limiting the rate and magnitude of these changes, including ocean acidification. Long-term mitigation of ocean acidification can only be achieved by actions that reduce CO₂-emissions. In the short-term, specific and general adaptation strategies are needed. For example, change in aquaculture practices has been shown to be an efficient way to minimize the negative effects of ocean acidification. Resilience of ecosystems to ocean acidification can be strengthened by implementation of marine protected areas, reduction of other, global, regional and local pressures or science-based ecosystem management (as described in Gattuso et al, Science Vol. 349, Issue 6243, 2015).

National efforts

Adaptation to ocean acidification is the aim of strategies developed by most other countries, but despite specific adaptation measures being potentially crucial for sustaining Swedish ecosystems, until now, Swedish efforts focus on the implementation of SDG 14.3 mostly by aiming at mitigation.

Sweden has a long record of accomplishment in environmental policies and introduced a carbon tax as early as 1991. Sweden now has the ambition of zero net-emissions of greenhouse gases by 2045. Also, the Swedish Parliament has adopted 16 environmental quality objectives (EQO), describing what state and quality of the country's environment are sustainable in the long term. The Swedish parliamentary committee for environmental objectives has proposed new emissions targets and a new climate change strategy. The Swedish Parliament ratified the Paris agreement in November 2016 and the Swedish Government adopted a proposal for Sweden's first climate act in February 2017. The act and new climate goals will give Sweden an ambitious, long-term and stable climate policy in line with the requirements of the Paris agreement, with the aim of significantly reducing CO₂ emission.

At present, the Swedish adaptation strategy to ocean acidification is non-specific and aims at a general increase in ecosystem resilience. SDG 14.3 "[...] address the impacts of ocean acidification" is implemented in Sweden in line with the overall ambition to achieve a balanced marine environment (EQO6) and Sweden's work towards the European Marine Strategy Framework Directive (MSFD) with a view to achieve Good Environmental Status (GES). Actions taken within this framework, such as eelgrass restoration, can provide multiple benefits, including mitigation of climate change ("blue carbon"), adaptation (e.g., reduced risk of coastal erosion, wave dampening) and support of biodiversity and marine resources.

Development of a more specific adaptation strategy requires local monitoring and research. Sweden supports research on ocean acidification both nationally and through international research cooperation. Several major project grants have addressed the direct and indirect

effects of CO₂-driven acidification on key species and ecosystems in Swedish coastal waters. These include effects of acidification on bloom-forming phytoplankton, early life-stages of invertebrates, calcifying shellfish and larger-scale mesocosm investigations in planktonic, and seagrass ecosystems. Swedish universities have pioneered research on ocean acidification and are major players in the field as highlighted by hundreds of scientific publications and state-of-the-art ocean acidification research facilities.

Regional efforts

European cooperation of relevance to SDG 14.3 includes work in line with EU-legislation such as the MSFD, Water Framework Directive (WFD), Marine Spatial Planning Directive (MSPD) as well as the Sulphur Directive (SD). Sweden also contributes to achieving the EU climate targets, including energy efficiency. Regional conventions and collaborations with links to SDG 14.3 include OSPAR, HELCOM and ICES. A common denominator of these collaborations is the goal of sustainable management of the marine environment. A joint working group of ICES and OSPAR produced a comprehensive report on the monitoring of ocean acidification and its impacts. SDG 14.3 is also addressed by several of the working groups under the Arctic Council (e.g. AMAP, CAFF, PAME). The Swedish EPA (SEPA) provides expertise on climate change to working groups of the Nordic council of ministers (NMR). SEPA supports the environmental working group of the Barents Euro-Arctic Council and the implementation of an action plan on climate change. SEPA also provides expertise to the Arctic council's expert group on black carbon and methane. This group aims to develop a "Summary of Progress and Recommendations" based on the national reports and other relevant information, and to develop an ambitious, aspirational and quantitative collective goal on black carbon. The UN Convention on Long-Range Transboundary Air Pollution (CLRTAP) focuses on improving air quality on local, national and regional levels, on continents and oceans. SEPA currently chairs the convention.

The European Earth observation initiative Copernicus provides extensive amounts of open near real time and archived data from a series of Earth Observation satellites and six thematic services, supporting marine and climate change science and management.

International efforts

International efforts include Swedish work within Global Framework Conventions relevant to ocean acidification (e.g. UNFCCC, CBD, UNCLOS), regional and sectoral agreements, scientific collaborations such as IPCC, WOA, IPBES, and environmental networks such as IUCN. Swedish scientists contribute to the recently established SCOR Working Group 149 on Changing Ocean Biological Systems. In addition, there are several international initiatives such as the Global Ocean Acidification Observation Network GOA-ON, a collaborative effort to coordinate the monitoring of ocean acidification, and the International Ocean Acidification Coordination Centre (OA-ICC), which have Swedish representation. Swedish researchers are leading the capacity building program of the OA-ICC, building laboratories and organizing trainings in developing countries. The Group on Earth Observations (GEO) has initiated the Blue Planet Task, and is aligning its work on the coordination of Earth observation with the specific objective of supporting Agenda 2030 and the SDGs. Sweden also cooperates with various UN-organisations relevant to ocean acidification.

SEPA provides ongoing assistance to the government in connection to climate negotiations within the framework of UNFCCC and their recurrent COPs and working groups. SEPA is also coordinating a long-term global program on environmental and climate cooperation with countries of strategic importance.

Good Examples

Enhanced scientific cooperation at all levels: Sweden has an active and collaborative research community in the field of ocean acidification. Many projects have contributed, and are presently contributing, to improved understanding of the chemical and biological impacts of ocean acidification. Current projects are also identifying possible policy and management responses. Unique knowledge gained from Swedish regional studies of the Arctic and the low-salinity Baltic Sea is making valuable contributions to the wider international context.

Minimise ocean acidification: Sweden has an international reputation as a climate leader and has presented an ambitious climate strategy. Mitigation of ocean acidification and climate change partly share the same solution. Thus, there are opportunities for cross-fertilisation of SDG 14.3 with the Paris agreement and SDG 13. The latter should be used as a lever for an upscaling of Intended Nationally Determined Contributions (INDCs) and should also be highlighted in the conference's "Call for Action" document.

Address the impacts of ocean acidification: Ocean acidification and climate change are cross-cutting to other environmental questions, and solutions will require broad, effective and efficient collaborations. Sweden benefits from well-established legal frameworks, institutions and processes (national environmental objectives, EU directives, regional conventions, regular assessment cycles, management frameworks, international processes). This provides multiple opportunities:

- To help poor countries achieve energy independence and break reliance on fossil fuels through increased use of renewable energy sources. The potential to enhance climate action at local levels is demonstrated by recent Swedish initiatives (e.g. "The Climate Step", Klimatklivet);
- To help poor countries, specifically Small Island Developing States (SIDS) and least developed countries (LDCs), with adaptation and establishment of climate-proof (and climate-smart) infrastructure. The latter is an absolute necessity if the target SDG 14.7 is to be reached in the context of acidifying and warming oceans, rising sea levels and other climate related risks;
- To encourage integrated ecosystem-based management of marine, brackish, and freshwater systems, promote best practices and take collaborative action to improve the management of land, water, coastal and marine linkages. Such linkages are integral to understanding the impacts of ocean acidification in the low-salinity Baltic Sea system.
- To advocate for reductions of other stressors that have negative impacts on the ecosystem, with a view to increase the resilience of ecosystems and their ability to tolerate ocean acidification and climate change. The latter includes actions on dangerous substances and litter that negatively impact the marine environment, e.g. upstream actions that reduce terrestrial sources (links to S2S), and reducing fishing effort, eutrophication and coastal pollution;

- To highlight the importance of biodiversity and to advocate for increased MPAs. Lessons learned from regional collaborations, e.g. in the Arctic, should be valuable in a wider international context, in particular with a view to adaptive management and connective networks that can ameliorate the unavoidable impacts of climate change and ocean acidification.

Challenges and Gaps

Implementation of SDG 14 requires translation of the SDG targets and indicators to national policies and targets. As a corollary, there is a need for a more explicit and strategic approach to address ocean acidification in the Swedish national EQO framework. Links of SDG 14.3 to other targets of SDG 14 (and other SDGs, notably SDG 13), need strengthening.

Implementation of SDG 14.3 requires increased awareness of ocean acidification, its impacts and associated environmental management options.

The timeline for the implementation of mitigation strategies at the global level is not sufficiently short to prevent the effect of ocean acidification on Swedish waters and associated industries. Fully addressing and minimizing ocean acidification in Sweden would require the development of a strategic research agenda deviating from a pure mitigation approach. Developing and implementing subsequent solutions requires a projection of effects in Swedish waters. This can only be achieved through:

- At present there is no sustained **monitoring** of ocean acidification parameters along Swedish coasts at high temporal resolution (weather; allowing to capture the present natural variability) and following best practices (SDG 14.3.1 methodology as developed by the SDG 14.3 custodian agency, the International Oceanographic Commission, IOC). To fully evaluate the exposure, this should be done on top of other key environmental local and global drivers.
- Understanding of the **effects of ocean acidification** on Swedish marine ecosystems and ecosystem processes (as distinct from marine species) is poor, yet needed for development of effective adaptation options. To bridge the observed physico-chemical changes to biological response, there is a need to understand:
 - The cumulative effects of additional drivers (e.g. fishing, eutrophication, hazardous substances, climate change) and, specifically, if and how these drivers interact.
 - Direct and indirect effects of ocean acidification through ecological interactions.
 - The key role of local adaptation to present natural variability and the capacities of key species to acclimate and genetically adapt to ocean acidification over the medium to long-term.
- Evaluate, develop and implement **strategies to address impacts** on Swedish marine ecosystems and industries. Only a combination of monitoring with an ability to project impacts on marine species, ecosystems and industries would allow to successfully implement solutions and successfully manage Swedish ecosystems. These solutions include:
 - Development of locally-relevant priority list of drivers based on both exposure and effects on key biological features.

- Identification on sensitive areas, species, ecosystems and industries would allow to prioritize ecosystem management (e.g. regulation of fisheries, marine protected areas).
- Innovations to increase ecosystems and industries resilience. For example, selection of resilient strains of key seafood species for aquaculture.
- The **economic consequences** of ocean acidification are poorly quantified. Research is urgently needed to identify:
 - Key ecosystem services that will be negatively impacted by ocean acidification, and estimate their monetary value; Future costs and economic consequences of ocean acidification for Swedish coastal communities, and the Swedish national economy.
- Understanding of **societal responses** to the consequences of ocean acidification (as distinct from climate change) is lacking. To develop relevant policy tools there is a need to identify:
 - The value of informative instruments in changing societal norms, and hence increasing public participation and engagement in addressing ocean acidification;
 - Effective market-based policy-tools that aid mitigation and adaptation.

Swedish efforts concerning sustainable fisheries

SUSTAINABLE DEVELOPMENT GOALS

TARGET 14.4:

By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

TARGET 14.6:

By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognising that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation.

Executive summary

- Fish is fundamental when it comes to feeding a growing population due to its high nutritional value; in addition, it generates livelihoods for millions of people around the globe. To ensure continued capture fisheries production it is essential that the fisheries sector becomes more sustainable.
- Fishing is the primary reason for the decline in fish stocks; even though negative environmental changes to the aquatic environment also contribute.
- Commercial fisheries, as well as, trade falls under the exclusive competence of the European Union (EU). In practice, the Commission represents European interest on behalf of its member states at bilateral, regional and multilateral levels.
- The EU Common Fisheries Policy (CFP) contains tools and measures that could, if they are implemented appropriately, ensure that the fish stocks in EU move towards sustainability. A measure in the CFP that will be a challenge to implement is the landing obligation. As a result, the whole catch must be landed, but individuals smaller than the minimum conservation reference size shall not be sold to human consumption.
- After a hiatus in the World Trade Organization (WTO) negotiations since 2011, there now appears to be renewed momentum. The difficulty is, however, for the WTO members to agree on necessary definitions and concepts.

- The Baltic Sea is the first region to develop a multiannual plan for several species. The plan has been adopted within the CFP framework and already been applied in fish quota setting for 2017.
 - The Swedish fishing fleet has declined during the past decade and is today, for most fleet segments, in balance with available resources.
 - In 2011 EU introduced enhanced traceability requirements for fishery and aquaculture products. In Sweden a fully electronic system, which is user-friendly and gives traceability along the whole value chain, has been developed in cooperation with those concerned.
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Swedish efforts concerning sustainable fisheries

Introduction

Fish is fundamental when it comes to feeding a growing population due to its high nutritional value; in addition, it generates livelihoods for millions of people around the globe. To ensure continued production from capture fisheries, it is essential that the fisheries sector as a whole, which includes commercial, subsistence and recreational fisheries, becomes more sustainable.

According to the FAO's State of World Fisheries and Aquaculture 2018, the state of the world's marine fish stocks has not improved overall, despite notable progress in some areas. Overfishing persists despite decades of efforts to manage fisheries in order to successfully conserve stocks at sustainable levels.

For the fisheries sector to be sustainable, it should deliver long-term benefits – ecological, social and economic – to society. There are many different views on what sustainable fishing is, or how fisheries should be managed to be sustainable.

In EU waters, progress has been made towards maintaining stocks above levels that can produce the maximum sustainable yield (MSY). Since 2006, the numbers of stocks fished in line with MSY criteria and within safe biological limits have increased greatly. There are, however, indications that the positive trend is weakening. This is not necessarily due to overfishing; there are other possible explanations, such as climatic changes or other biological factors. In addition, there are strong regional differences in EU waters; most progress has been made in the North Sea and least in the Mediterranean and Black Seas.

Fishing is the primary reason for the decline in fish stocks; even though negative environmental changes to the aquatic environment also contribute. A reduction of fishing pressure is therefore an important step to achieve healthier fish stocks. There is also a broad recognition that an ecosystem approach to fisheries management is needed to achieve sustainable fisheries. A fishery that accounts for interactions between fisheries and other impacts on fish stocks and that integrates fisheries management into broader governance frameworks.

Sweden's regulatory competence within the EU Common Fisheries and Trade Policies

Fisheries, along with trade, falls under the exclusive competence of the European Union. In practice, the Commission represents European interests on behalf of its member states at bilateral, regional and multilateral levels. The possibility for Sweden to act on its own in international negotiations regarding fisheries, whether it concerns management or trade, is therefore limited.

The EU Common Fisheries Policy (CFP) applies to conservation of marine biological resources, the management of fisheries and fleets exploiting marine biological resources and – in relation to measures on markets and financial measures in support of the implementation of the CFP – fresh water biological resources, aquaculture, and the processing and marketing of fisheries and aquaculture products. Member States may enact national control measures, which go beyond minimum requirements in Union legislation and may enact national measures on conservation and management.

A section on the external policy is included in the CFP, which is basis for EU activities in international fisheries organisations, most notably regional fisheries management organisations (RFMOs), and principles and objectives for EU fleets operating in waters of third-country coastal States, through the so-called “sustainable fisheries partnership agreements” (SFPAs). Through the EU external policy, Sweden has the possibility to influence EU actions within RFMOs and SFPAs of relevance for developing states. This part of the CFP gives Sweden a clear opportunity to act in line with the intentions of Sweden's Policy for Global Development.

National efforts

Close to the coast, often outside river mouths, there are about 400 areas where fishing is restricted to angling, which is only allowed during certain parts of the year. These restricted fishing areas have been designated as a measure to protect fish during the spawning season and are mainly directed at migrating fish such as salmon and trout. Lately they have also been designated to protect species such as pike and pikeperch. Sweden has also designated a number of areas where no fishing is allowed, equivalent of 2/3 of the total area of no-take zones in EU-waters, in order to allow recovery for specific stocks. A recent evaluation of Swedish experiences of no-take zones shows that this is an effective complement to other management measures that can be profitable for fisheries in the long run. The use of closed areas may also have positive effects on the ecosystem at large, and improve its abilities to deliver ecosystem services.

Within the national mandate of fisheries regulation, Sweden has introduced a ban on trawling in most areas within 3-4 nautical miles of the coast, a so-called “trawl limit” to protect important fish habitats and other vulnerable habitats that may otherwise be negatively impacted by trawling. The trawl limit was extended to its current extent in 2004 to protect mainly hard bottom habitats mapped out in seabed surveys and which are important to fish and other species.

In order to have fishing capacity in balance with available resources efforts have been made, in Sweden as well as in the EU at large, to reduce the size of the fishing fleet. As a result, the

Swedish fleet has declined during the past decade with regard to both the number of vessels and tonnage and engine power. Today, indicators show that for most Swedish fishing fleet segments, no overcapacity exists. This decline is primarily a result of subsidies for scrapping fishing vessels, transferable fishing rights in the pelagic fishery, regulation of eel fishing, and poor profitability. Swedish fishing contributes economically to the fishing communities, although there are significant variations between different sub-sectors. While the Swedish catching sector does not employ a large number of people in relation to other industries, the fishing industry in a wider definition (including e.g. processing) is important for many coastal communities.

Sweden has long running programme of development of selective fishing gears. In the programme fishing industry, researchers and authorities work together to develop new options for selective gears that avoid unnecessary by-catches and thereby help to fulfil demands of the landing obligation. As an example in 2018, more than half of Swedish landings of Norway lobster are now caught with pots or using trawls with a so-called “Swedish grid” that is designed to minimise by-catches of non-target species such as cod.

In Sweden, sixteen stocks of Baltic salmon are classified as wild by International Council for the Explorations of the Seas (ICES) as well as eight stocks in rivers with hydro-power stations that are maintained through compensatory re-stocking of salmon smolt. Fisheries have mainly been within main basin and coastal areas in the Baltic Sea, which are feeding and spawning migration areas for salmon without the ability to differentiate between individual stocks.

Since 2013, Sweden has managed a successful salmon management programme of phasing out fishing on mixed salmon stocks. Nowadays commercial fishing for salmon can only take place with static gear in the estuary of salmon rivers.

In 2011 the EU introduced enhanced traceability requirements for fishery and aquaculture products. The main reason was the need for improved monitoring of catches by extending control to the entire marketing chain. EU traceability requirements imply that all operators in the food chain, such as fish receivers, wholesalers and retailers should have systems and procedures for traceability of fish products, where information (such as species, geographical origin, capture date etc.) shall follow the fish from the catch to the plate.

In Sweden, the lack of relevant international traceability standards meeting EU-demand and the complexity of a digital traceability system delayed the construction. About 300 operators was expected to use the system and today (April 2020) 262 are connected. Aside from some exceptions, the production launch date of the system for operators was January 1st 2019. Compliance is still relative low, which has called for actions. The industry has paid attention to the extra administrative burdens the system provides and thus competitive disadvantages.

Regional efforts

To improve efficiency, and to avoid the overly detailed regulation at EU level that characterised the previous fisheries policy, the new CFP follows a bottom-up approach to governance and management, by means of so-called “regionalisation” that allows Member

States and stakeholders at the regional level to develop measures based on the specific circumstances and requirements of their local environment. Sweden is an active part in the regionalisation processes, one for the North Sea and one for the Baltic Sea.

The Baltic Sea is the first region to develop a multiannual plan for several species, which has been adopted within the CFP framework and already been applied in quota setting for 2017. The multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea and the fisheries exploiting those stocks will contribute to long-term management of stocks based on scientific advice and strengthens the opportunities to achieve MSY targets. The plan sets out conservation reference points and intervals for fishing mortality based on ICES advice, and demands further remedial measures in case these are not achieved. The plan will also contribute to the implementation of ecosystem-based management and coherence with EU environmental legislation including achievement of good environmental status in line with the Marine Strategy Framework Directive.

Concerning subsidies the CFP contains a few categories of subsidies that could be considered capacity enhancing, such as support to infrastructure in ports and landing sites, and investments on fishing vessels to enhance the quality and added value of the catch. Nevertheless, the major part of grants given are there to help the fishery sector move towards a more sustainable use of the resource. Most of the subsidies that are a part of the CFP and could be considered capacity enhancing, Sweden have decided not to use.

Discussions in the WTO concerning fisheries subsidies, in which an agreement has been hard to reach, Sweden, through the EU, have supported the more pragmatic approach where certain forms of subsidies be prohibited. It will hopefully be easier to agree on the different forms of subsidies that are unsustainable, than to agree on a useful definition of sustainable fishing. Fuel subsidies might become an issue for discussion, as they constitute a large proportion, 22 percent, of total subsidies. Fuel subsidies are not part of the CFP, but regulated through the directive for taxation of energy products and electricity, which prohibits EU member states to impose a tax on fuel to be used in commercial shipping.

Challenges and Gaps

- In 2013, a new Common Fisheries Policy was agreed, effective from 1 January 2014. The CFP requires that fish stocks should be exploited at levels allowing them to be above levels consistent with Maximum Sustainable Yield by 2015, where possible, and by 2020 at the latest. The CFP contains tools and measures that could, if they are implemented appropriately, ensure that the fish stocks in EU move towards sustainability.
- The gradual introduction through the CFP, from 2015– 2019, of a landing obligation for all species regulated by quotas in EU waters, is expected to be a strong driver for a reduction in unwanted catch and discards, thus contributing to less waste and more efficient resource use. The landing obligation is a significant change as well as a challenge for large parts of the Swedish fishing industry. As a result, the whole catch must be landed, but individuals smaller than the minimum conservation reference size shall not be sold for human consumption. Instead, this catch shall be restricted to other than direct human consumption. The possibility of increasing the share

above the reference size can be a driving force for fishers to develop fishing techniques to maximise the value of fishing possibilities. It requires an adaptation of gears as well as rules for fishing areas and at what times fishing activities may take place. Sweden has introduced a regulation where fishers can lease quota from each other in order to match their quotas with actual catches. This reduces the incentives for illegal discards in multispecies fisheries and limits the risk of fishers not being able to fish due to limited quota for bycatches.

- Within the framework of the EU's common efforts to combat illegal, unreported and unregulated fishing (IUU) different measures for controlling fishing activities are used. In addition, there are trade related measures in place with the purpose to prevent illegally caught fish to enter the EU market.
- With the objective to improve compliance with the EU Control Regulation and IUU Regulation, Sweden has introduced a risk-based control approach in which Swedish Agency for Marine and Water Management (SwAM) IT-system has proved to be an effective tool. Next challenge for SwAM in its efforts to control IUU-fishing is to establish a system for administrative sanctions in accordance with the legislative changes that entered into force on 1 August 2016.
- The international community is in agreement to eliminate subsidies that contribute to overcapacity, overfishing and IUU-fishing, and the main process for doing this is through the World Trade Organization (WTO). After a hiatus in the WTO negotiations since 2011, there now appears to be renewed momentum in the negotiations, and the aim is currently to conclude the negotiations on fisheries subsidies at the WTO ministerial conference in December 2017. The difficulty is, however, to agree on necessary definitions and concepts. Concepts such as sustainable fishing and overfishing as well as small-scale fisheries currently has no internationally accepted definitions, which are precise enough to use in an agreement. To agree on a goal in a UN declaration is generally easier than to agree on specific and binding regulations in the WTO, which will have consequences if breached.

Swedish efforts concerning science and technology

SUSTAINABLE DEVELOPMENT GOALS, TARGET 14.A:

Increase scientific knowledge, develop research capacity and transfer marine technology, considering the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries.

Executive summary

- Sweden has a well-developed institutional infrastructure for research and technology development, and the tradition of advanced industry related to the maritime sector is strong. Sweden has developed marine policies and a maritime strategy, both of which encompass marine science and technology strategies to build the required human and technical capacities for increased and improved research and development of the blue economic sector.
- The Swedish government's primary actions for research are through grants given to national research bodies. Support for research, technology development, and know-how transfer are also part of the national agencies' responsibilities. Regional bodies are financing and stimulating research as well as giving support to transferring research to commercialisation. Co-funding from national agencies is an approach used to stimulate collaboration and gear up grants from other financial sources. In the Triple Helix model, science and technology meet society in collaborative activities, together with the development of platforms such as test beds and incubators. These approaches help with integrating research into society. For knowledge transfer and capacity building, Swedish society is involved at all levels including the civil and private sectors.
- Technological developments are taking place in parallel with research to improve existing technologies. New technologies currently being developed in Sweden include mobile wind turbines, wave power, energy extraction from ocean currents, and growing biomass at sea for energy production. Maritime informatics is one of the fastest growing branches in maritime science.
- Areas of research with major data knowledge gaps exist from the cumulative effects of additional stressors, such as fishing, eutrophication, hazardous substances, and climate change impacts. Moreover, tools for the economic valuation of ecosystem services, couplings between social behaviours and their effects on the environment, and the economic consequences of ocean acidification are all examples of identified research needs within socio-economics.

- Swedish universities, and most parts of society, are in one way or another involved in regional and/or international collaborations, research programs, twinning projects, and bilateral cooperation. All of these efforts contribute to the development of new knowledge, capacity development, technology, and knowledge transfer.

Swedish efforts concerning science and technology

Introduction

Scientific understanding is essential to forecasting, mitigating, and guiding the adaptation of societies to the ways oceans affect human lives and infrastructures at different spatial and temporal scales. Sweden, like many other countries, has established institutional infrastructures to carry out specific activities or programs related to marine science and technology development.

In spite of these efforts, the current processes are not keeping up with the pace of changes in the oceans. There is a need to better understand ecosystem processes and functions and their implications for ecosystem conservation and restoration, ecological limits, tipping points, socio-ecological resilience, and ecosystem services. There is also a need to further develop and make use of existing technologies as well as those under development. Know-how transfer and financial support are essential for meeting the challenges.

There is also an urgent need to invest in applied research and innovation in order to actually implement gained knowledge into action fields. In other words, in parallel with more basic understanding about ecosystem processes, the restoration of marine ecosystems cannot be on hold waiting for more knowledge. The threats, for example climate change and losses in biodiversity, are so severe that action is needed now.

Swedish science and technology infrastructure

Sweden is a leading nation in the amount of money (in relation to GDP) that it devotes to research and development. The country has a well-developed institutional infrastructure for research through research councils and national agencies, including specific programs related to marine and maritime science. Sweden also has a tradition of advanced industry related to the maritime sector. Sweden has developed marine policies and a maritime strategy, both of which encompass marine science and technology strategies to build the required human and technical capacities for increased and improved research and development of the blue economy sector.

The Swedish government's primary actions for research are through grants given to national research bodies, such as the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, or Formas. Research related to the marine and maritime fields are carried out in natural science as well as in social science and technology development. The Triple Helix is a model in which science and technology meet society in collaborative activities, together with the development of platforms such as test beds and incubators. These approaches help with integrating research into society. Collaborations between

technical universities and private industries play an important role in technology development.

Responsibilities for the financial support of research, technology development, and know-how transfer also fall to national agencies, such as the Swedish Agency for Marine and Water Management (SwAM), Vinnova, the Swedish Agency for Economic and Regional Growth, the Swedish Energy Agency, the Swedish Maritime Administration, and the Swedish Meteorological and Hydrological Institute (SMHI). Regional bodies, such as Region Västra Götaland, are also financing and stimulating research as well as transferring research to commercialisation. Co-funding from national agencies is an approach used to stimulate collaboration, provide ownership of projects, gear up grants from other financial sources in projects, and provide more action on a local level.

In addition to classical and technical universities, Sweden is also home to a number of collective action research centres such as the Swedish Environmental Research Institute, the Swedish Institute for the Marine Environment, the Stockholm Resilience Centre, and the Stockholm Environment Institute. The newly established Kristineberg Marine Research and Innovation Centre is a centre for promotion of marine research and innovation for blue growth/economy including universities and research institutes like Chalmers, KTH, University of Gothenburg, RISE and IVL. For knowledge transfer and capacity building, Swedish society is involved at all levels including the civil and private sectors.

National efforts

In Sweden, well-designed monitoring programs have been in place for decades and are continuously under development to better suite new management conditions. Moreover, data from the monitoring programs can also provide a platform for further research.

Research needs identified by SwAM and the Swedish Environmental Protection Agency are funded by environmental research grants. Research projects that develop methods to value marine ecosystem services and indicators for the Marine Strategy Framework Directive is one example.

Technologies in the maritime sector currently being developed in Sweden include mobile wind turbines, wave power, energy extraction from ocean currents, and growing biomass at sea for energy production. Maritime informatics is one of the fastest growing branches in maritime science. In one of Sweden's regions (Västra Götaland) exists a cluster area with around 800 companies within marine technology and shipping. Products include everything from material development, design, and consultancy to traditional manufacturing industry and maritime informatics.

Ocean waves have potential to contribute significantly to a future sustainable global electricity production. Uppsala University is at the forefront of wave energy research. In a wave power park on the Swedish west coast different technological solutions are tested and the environmental impact on the marine environment is studied. The research site is one of the few off-shore test sites for full-scale wave energy converters in the world. Another example of sustainable energy production at sea is the development of a floating wind turbine made for the ocean.

Authorities and industries in Sweden have cooperated in devising tools, such as the Clean Shipping Index and the Zero Vision Tool, to make shipping more environmentally friendly, safer, and energy efficient. Ships fuelled by LNG, methanol, and electricity already exist even if the numbers still are few.

Sweden is also the initiator of the Sea Traffic Management project. The project aims to provide information sharing tools which will assist both people on board and ashore in their decision-making process. This is envisaged to increase efficiency, improve safety, and enhance the protection of the marine environment. Other examples of measures undertaken by Sweden to facilitate technology development are international efforts to gain acceptance to build ships in fibre reinforced plastic.

Sweden has also taken measures on a national level to reduce the discharge of sewage. Since the 1990s, ships have been prohibited from discharging sewage in Swedish waters. Pleasure crafts have also been prohibited to release sewage into the water. The development of selective fishing methods and gears to reduce environmental impacts and by-catch are taking place. For example, the Scandinavian grid, a selective fishing gear that significantly decreases by-catch, has been developed. Moreover, methods to trace back where the fish has been caught has been development and implemented, in line with the landing obligation program.

The Swedish Algae Factory is an example of a circular business model, based on microalgae's natural cycle, in which aqua culture is combined with the production of a number of products such as energy, oil, and fertilisers. Marin Biogas AB cultivates and harvests ascidians from the sea where the process gives several environmental and economic benefits as well as products feed, ecological fertilisers, and biogas. KosterAlg AB is a new company starting to cultivate seaweeds on the Swedish west coast in order to provide biomass for biorefineries that may produce food, feed and bio based materials and in the same way providing a better environmental situation in the open sea where the seaweeds are cultivated.

Regional efforts

Sweden is engaged in several European and Nordic initiatives to strengthen marine research and innovation. Some examples are given below:

- The Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans). Sweden and France are leading a JPI-Oceans initiative to establish a research network and an agenda for marine ecosystem services-based assessments for marine spatial planning (MSP) and the MSFD. JPI Oceans has, for example, also funded projects that investigate the concentration and effects of microplastics in the marine environment.
- The Joint Baltic Sea Research and Development Programme (BONUS) will soon develop into the new program BANOS that will include both the Baltic Sea and the North Sea.
- The Nordic Council of Ministers has funded marine research projects that investigate ecosystem services and their value, as well as a tool to incorporate the ecosystem services approach into MSP.

- At the EU level, cooperation is ongoing to compile joint databases for the marine environment and monitoring. Copernicus, for example, provides extensive amounts of open near real time and archived data from a series of earth observation satellites. The EU Strategy for the Baltic Sea Region aims to deepen cooperation between the countries around the Baltic Sea in order to meet the common challenges the region is facing today.
- The HELCOM Baltic Sea Action Plan (BSAP) is an ambitious programme to restore the good ecological status of the Baltic marine environment by 2021.
- SUBMARINER is a EU flagship network devoted to apply for and initiate sustainable projects for the blue growth/economy agenda, with many Swedish partners both regions, universities and research institutes. The network has a very good track record and runs several large projects.
- The WATERBORNE Technology Platform is one of roughly 30 technology platforms in the EU. Where appropriate, possibilities for exchanges or other ways of cooperation are investigated. The Waterborne community has issued the Waterborne Declaration in which it commits to helping to achieve the “Europe 2020” objective of smart, sustainable, and inclusive growth.
- MareFrame is a European Commission-funded research and technological development project which seeks to move barriers that prevent a more widespread use of the ecosystem-based approach to fisheries management.
- The European Project on Ocean Acidification (EPOCA) is an example of a regional research project with relevance to ocean acidification and resilient ecosystems. The overall goal for the project is to further our understanding of the biological, ecological, biogeochemical, and societal implications of ocean acidification.
- Many regional projects are done in close collaboration with HELCOM and OSPAR, the Regional Sea Conventions for the Baltic Sea and the North-East Atlantic respectively.

International efforts

Sweden is a well-regarded and respected country in multi-lateral cooperation. Our long-standing role as a credible donor and important policy actor has resulted in many opportunities to influence developments that are far greater than our country’s size would merit. Sweden works in several international and regional organisations, such as UNDP, ICES, FAO, and IMO, in order to, among other things, strengthen the protection of marine environments, promote an ecosystem-based approach in marine spatial planning, reduce marine litter and pollutants, develop more environmentally friendly and safer shipping traffic, and implement research and new technology.

The Swedish International Development Cooperation Agency (Sida) plays an important role, giving support to national research programs in developing countries and regional development organisations as well as financing international training programs for professionals. An important focus is on increasing capacity for coastal communities’ involvement in establishing sustainable livelihoods and building improved resilience, as well as mainstreaming gender and equality perspectives in supplementary livelihood frameworks.

National research bodies, such as the Swedish Research Council, together with sector agencies, such as SwAM, the Swedish Energy Agency, and SMHI, and Swedish universities, both classical and technical, contribute to know-how transfer worldwide through bilateral

collaboration, twinning projects, and joint research projects and programs. The Swedish Research Council is, for example, working through the global Belmont Forum.

Sweden supports research on ocean acidification both nationally and through international research cooperation. Sweden has worked internationally to amend the legal framework in order to facilitate the use of alternative fuel for shipping. In addition, the Swedish Transport Agency has worked closely with Swedish ship owners who have expressed a will to convert their existing vessels.

Sweden is a member of the International Council for the Exploration of the Sea (ICES). Sweden participates in many ICES working groups addressing ecosystem-based management. Through our engagement in ICES, we are involved in the work of the North Pacific Marine Science Organisation (PICES) and the Northern Atlantic alliance.

The UNDP Water and Ocean Governance Programme (WOGP) helps countries achieve integrated, climate-resilient, sustainable and equitable management of water and ocean resources, and universal access to safe water supply and sanitation. Focusing on governance, WOGP supports partnerships for a sustainable use and protection of freshwater and marine resources.

Sweden is involved in work considering the protection of marine areas in the Arctic and in Antarctica.

Challenges and Gaps

- In order to foster innovation and promote the use of new and innovative technologies, regulatory framework should, where possible, be function based. Goal-based rules need to be developed to create better conditions for innovation and the use of new technologies. Creating the right incentives for industry will be a key to the sustainable use of the oceans and, in the long term, determine the value of the potential of the ocean economy as such.
- Maritime informatics is one of the fastest growing branches in maritime science. It constitutes an area that might help improve safety, reduce impacts on the marine environment, and grow into an emerging industry in itself, if we can efficiently make use of it.
- Ocean management should be based on sound scientific research and knowledge. There is a need to strengthen international cooperation on ocean research and data exchange. Increased coordination or the integration of research programs is needed to tackle common problems on regional and global levels.
- Marine and maritime science need to find ways of applying a holistic approach toward understanding and addressing the cumulative impacts of various threats such as climate change, pollution, coastal erosion, and over-fishing.

- Data and knowledge gaps exist with respect to pollution, including all aspects of the life cycle of marine debris, plastics and microplastics, heavy metals, and other hazardous substances.
- The precise scope of the impacts of acidification on the marine environment remains unclear and more research is needed.
- There is a need to promote and build capacity for better ocean governance, conservation and restoration of marine ecosystems and biodiversity, and the sustainable use of marine resources (blue economics).
- Mariculture, and especially cultivation on low trophic level organisms such as mussels and algae/seaweeds, and Ocean Literacy has been identified as important topics that needs to have a focus during the UN Decade of ocean science for sustainable development (2021-2030). There is also need for more social science to complement the natural sciences.

Swedish efforts for sustainable blue growth and sustainable small-scale fisheries

SUSTAINABLE DEVELOPMENT GOALS

TARGET 14.7:

By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism.

TARGET 14B:

Provide access for small-scale artisanal fishers to marine resources and markets.

Executive summary

- The concept of blue growth has developed alongside green economy in order to promote economic growth, social inclusion, and the preservation or improvement of livelihoods while at the same time ensuring environmental sustainability of the oceans and coastal areas .
- The concept encompasses a wide range of different sectors, such as mineral extraction, tourism, energy production, aquaculture, fishing, recreation, shipping, culture, and traditional production and processing industries.
- Small-scale fisheries is one of the traditional sectors in the blue growth concept. They are of significant importance as they comprise 90 percent of the world's capture fisheries. The vast majority of small-scale fisheries are located to developing countries. The small-scale fisheries are the hardest hit as catch decreases.
- A great deal of research and development work is being carried out in connection with blue growth within several sectors, not least within energy, shipping, and aquaculture.
- Advanced management models and cross-sectoral cooperation – as well as collaboration between the public and private sectors – are important in order to achieve sustainable blue growth. The Swedish Maritime Strategy is a good example of a multisectoral way of working.
- The Swedish fishing grounds in northern Bohuslän, specifically the Koster-Väderö area, provide the foundation for a small but profitable coastal fishery that is managed in a sustainable manner. This has been achieved through co-management between local fishers, researchers, government agencies, and local municipalities.

- Sweden is actively involved in regional and European cooperation to develop new methods and industries, and is striving for sustainable blue growth. Globally, Sweden supports international bodies in the work to achieve blue growth and sustainable global management of marine resources.
- Blue growth needs to be operationalized in order to have a real impact and several existing challenges must be addressed. Improvement are required within a number of areas, such as advanced systems thinking, improved cross-sectoral management models, and political initiatives to regulate and restrict resource extraction.

Swedish efforts for sustainable blue growth and sustainable small-scale fisheries

Introduction

The concept of blue growth has developed alongside green economy in order to study and consider the economic benefits generated by coasts and oceans in all aspects of economic activity. The United Nations Environment Programme, UNEP, has defined green economy as an economy that “results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.” A widely accepted definition of the concept of blue growth is yet to be agreed upon and the term therefore can include different meanings and approaches, depending on the social contexts in which it is used.

The concept of blue growth is a call for a more holistic management of complex marine social-ecological systems. It encompasses a wide range of different sectors, such as mineral extraction, tourism and recreation, energy production, aquaculture, fishing and shipping. Therefore, a number of different perspectives has to be considered, including cumulative impacts from different sectors. Blue growth is also linked to traditional production and processing industries.

Small-scale fisheries is one of the traditional sectors in the blue growth concept. They are of significant importance as they are environmentally and socially preferable to large-scale fisheries and comprise 90 percent of the world’s capture fisheries. The vast majority of small-scale fisheries are located to develop countries where they contribute to over half of the fish and invertebrate catch. The small-scale fisheries are the hardest hit as catch decreases.

Swedish efforts

The Swedish governance approach is inclusive and strives to achieve environmental targets in a multisectoral manner. The implementation of policies is based on cooperation and stimulation between different levels and actors within society, such as the state, regions, municipalities, research institutions, civil society, and industry. This is done through governance by assignment, financial means, and dialogue with the actors involved. One good example is the Swedish Maritime Strategy with indicators for follow-up. Another is the co-management of fisheries in the Koster-Väderö Fjord Agreement. The aim of the

agreement is to develop a sustainable fishery compatible with the region's outstanding natural values.

Energy

Offshore energy productions comprise a wide range of activities and are experiencing rapid progress. Sweden was one of the first nations in the world to make use of offshore wind power. In Europe (including Sweden), offshore wind power is expanding. At the same time, technological development and research are taking place in parallel, both to improve existing technologies and to develop new ones. New technologies currently being developed in Sweden include mobile wind turbines, wave power, energy extraction from ocean currents, and growing biomass at sea for energy production. Off-shore energy extraction and production generate the need for transporting energy using cables, pipelines, and shipping. Increased off-shore energy production is expected to boost the development of maritime industries and contribute toward an increased proportion of renewable energy and reduced CO₂ emissions. The energy sector is also creating extensive maintenance and service industries.

Tourism and recreation

Tourism is one of Sweden's fastest growing industries and is now a basic industry in a number of coastal communities. It is often locally based, small scale, and diversified, and contributes toward a vibrant rural area and growth for small businesses. It is based on cultural and natural experiences. In many cases, tourism strives to achieve locally based development and backing in order to be sustainable. This does not count for the cruise traffic, which in the Baltic Sea consists of around 2 million passengers annually. It is mainly a large-scale operation and has minor positive impact on local society. Cruise ships mainly call at larger port cities. Stockholm accounts for the majority of ports of call made in Sweden.

Commercial fishing

The stocks of fish and shellfish are renewable resources that can contribute to a greater degree toward putting nutritious food on our plates. This assumes that fishing is carried out in a manner that is environmentally sustainable in the long term, ensuring the survival of fish stocks. The last hundred years, the fishing sector has decline substantially in Sweden. Around 1945, there were about 25 000 professional fishers in Sweden. This number has constantly declined since then and the small-scale fishing sector is the most affected. In 2017, the number of small-scale Swedish fishers was estimated to be around 400.

Local fishing communities are dependent on the fish in the immediate vicinity, and fishing is often carried out on a small scale or seasonally. The sustainable economic development of society and businesses thus requires a diversification to include other activities. Many companies therefore supplement their operations by investing in activities such as smoking and selling fish, camping, and marinas.

Co-management of small-scale fisheries in northern Bohuslän

The fishing grounds in northern Bohuslän, specifically the Koster-Väderö area, provide the foundation for a small but profitable coastal fishery that is co-managed by local fishers, researchers, the county administration, the Swedish Agency for Marine and Water Management, and politicians from the local town councils of Strömstad and Tanum. A large

part of the area consists of Natura 2000 areas. The area has a valuable marine biodiversity and is regarded as Sweden's most species-rich sea area. In the co-managed area lies, since 2009, Sweden's first marine national park, Kosterhavet. In 2011, a marine nature reserve surrounding the Väderöarna islands in the southern part was also established. Both of these protected areas are located entirely within the waters that are co-managed.

The co-management board has decided on their own operational rules that secure tenure for small-scale fishing operations. The most important rules are a maximum of three days at sea (market driven); no fishing at night; a maximum of three men onboard (sharing the harvest); trawling is not permitted in water shallower than 60 meters in depth; use of selective trawls with low impact; protected areas; and seasonal stops.

Both commercial and recreational fishing are widespread in the area. Shrimp is the most economically important fishery; around 30 vessels fish shrimp in the area. The fishing can be conducted with relatively small vessels since it takes place close to shore and in protected waters. The fishers in the area also work with a self-inspection system, tool development, and marketing. The latter has resulted in their own brand, Njord, which helps to promote products from this well-managed fishery. Commercial fishing in the Koster Väderö area is today a long-term sustainable fishery, conducted in a responsible manner to protect the area's high conservation value.

Shipping

Shipping is the dominant form of transport for Swedish foreign trade, accounting for approximately 90 percent measured by volume. In addition, around 30 million passengers per year are transported to and from our neighbouring countries by ferry. The shipping sector and related businesses employ around 100 000 people. Enhancing the competitiveness of Swedish ports in order to contribute toward a more highly developed transport system is a priority together with improved environment. There is a desire to transfer land transport to sea transport. In 2017, a strategy for how to achieve a fossil-free transport sector will be presented. Through continued development of means of control, emission reduction, type of fuel used, and improved technology, shipping can be transformed into a more environmentally friendly means of transport with great significance for sustainable blue growth. Authorities and industries in Sweden have cooperated on devising tools such as the Clean

Shipping Index and the Zero Vision Tool to make shipping more environmentally friendly. Safety at sea and prevention of transfer of alien species are other example of prioritised topics together with issues around tank washing. New areas of technology, such as within digital applications, are part of the emerging blue growth. The Västra Götaland region is a cluster area for marine technology, with around 800 companies in the region working within marine technology and shipping. Products include everything from material development, design, and consultancy/guidance to the traditional manufacturing industry.

Marine spatial planning

Marine spatial planning deals with the marine spatial aspects of all the thematic areas included in sustainable blue growth. It is commonly defined as "...a public and coordinated process of mapping, evaluating and assigning marine areas to different human activities in order to achieve ocean health and transform marine governance". Marine spatial planning is

a national process but requires cooperation between states in order to achieve the desired effects. In Sweden and around the Baltic, there is an ongoing process to develop ecosystem-based marine spatial plans. It is important to identify the most suitable geographic area for an activity and the objective is to balance and weigh different interests and to point out future uses. Identifying and highlighting areas worth protecting and the connectivity between them in order to shield them from exploitation are important aspects. Further, it is also necessary to deal with land-sea interactions and relates to the climate target and opportunities for development in the coastal area.

Regional efforts

Swedish actors from authorities, civil society, and industries are involved in a number of organisations and projects within the framework of regional cooperation, for example within HELCOM (the Baltic marine environment protection commission), the BONUS research program and its successor BANOS, and the Baltic Sea Region Programme. The cooperation involves improving the environment and developing new sustainable industries and areas of technology.

International efforts

Sweden works both bilaterally and through various global and regional organisations to respond to challenges, primarily to coastal communities in coastal least-developed countries (LDCs) and small island developing states (SIDS) contributing to the fulfilment of SDG 14 and its sub targets. This includes more than 30 contributions and around SEK 400 million annually to the World Bank, The Food and Agriculture Organization of the United Nations (FAO), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), the International Union for Conservation of Nature (IUCN) and others. livelihoods and resource base for poor coastal communities and marine pollution in LDCs and SIDS. By supporting the work with a Sustainable Blue Economy by key players such as the World Bank through ProBlue (The World Bank's blue economy program), UNDP, and UNEP the economic sectors are integrated to improve the marine environment and to strengthen local society's capacity for sustainable development in both coastal and marine areas. Efforts to reduce the pollution by plastics are widely implemented and the UNDP Ocean Innovation Challenge is a new mechanism designed to accelerate progress on SDG 14.

In the shipping sector, Sweden is instrumental in the global and regional arenas and is working through conventions and organisations such as SOLAS (the international convention for the safety of life at sea), MARPOL (the international convention for the prevention of pollution from ships) and IMO (International Maritime Organization) to improve management and environmental standards, rules, and regulations. Sweden is also hosting and contributing to the World Maritime University located in Malmö.

Challenges and Gaps

Collaboration between the public and private sectors is important in order to achieve sustainable blue growth. Blue growth needs to be operationalized in order to have a real impact. Several existing challenges must be addressed:

- Ensuring ecosystem's need for reproduction and stability while not excluding all resource extraction requirements from the industry.
- Develop approaches and technology to minimize impact on marine ecosystems from mineral extraction, energy production and shipping.
- Increased knowledge and understanding of the structure, function, and value of ecosystems.
- The development of management models that are able to deal with cross-sectoral perspectives and multisectoral cumulative consequences.
- Statistical data to substantiate the value of blue growth.
- Clear political initiatives to regulate and, if necessary, restrict resource extraction.

It is important to have proper allocation mechanisms and ensure transparency in order to develop effective natural resource management. When it comes to small-scale fisheries, ineffective governance of tenure often constitute a major obstacle to a sustainable, efficient, and equitable use of fishery resources. Challenges concerning the sustainability of small-scale fisheries include:

- To stop and reverse the decline in the Swedish small-scale fisheries sector without disregarding the value of new economic profitable and sustainable marine industries.
- To recognize and integrate small-scale fisheries societal values, economic and non-economic, in the implementation of the Marine Spatial Planning Directive.
- To improve the economic profitability of small-scale fisheries without compromising the sustainable exploitation of marine resources and through access to new (local) markets for their products.
- To replicate and learn from the lessons of the co-management model of small-scale fisheries in northern Bohuslän.
- To take measures to alleviate the competition between seals and cormorants' populations and the small-scale fisheries
- To simultaneously implement the Blue Growth agenda and the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries.

Swedish efforts concerning UNCLOS

SUSTAINABLE DEVELOPMENT GOAL, TARGET 14.C:

Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want.

Executive summary

- The Swedish Agency for Marine and Water Management (SwAM) was created to increase the integration of relevant policies to achieve a unified and coherent management of the aquatic resources in rivers, lakes, and the sea.
- Sweden has a long tradition of an adaptive legislation for the protection of the environment including the marine environment.
- Sweden works actively nationally as well as in several global, international, and regional organisations in order to strengthen the protection and conservation of the marine environment.
- Among the actions taken on the national level is the program of measures for the Marine Strategy Framework Directive (MSFD) including actions to lessen the environmental impact from shipping and other sources with regard to sewage, invasive alien species, and pollution by hazardous substances and marine litter.
- Sweden follows a tradition of regional cooperation with the regional sea conventions OSPAR and HELCOM, as well as regional fisheries organisations, and has taken part in or initiated several actions to improve the status of the Baltic Sea and the North Sea.
- Effective implementation of the international framework supporting UNCLOS is of key importance to fulfilling sustainable development goal (SDG) target 14.

Swedish efforts concerning UNCLOS

Introduction

Since the adoption of the United Nations Convention on the Law of the Sea (UNCLOS or LOSC) 1982, 168 states including Sweden (1996) have ratified the convention. Two supplementary implementing agreements to UNCLOS have been elaborated: the Agreement relating to the implementation of Part XI of UNCLOS as an answer to the needs addressing certain difficulties with the seabed mining provisions contained in Part XI of the Convention; and the so-called Fish Stocks Agreement or UNFSA from 1995. The ratification rates of these are, however, lower, 150 and 85 states respectively. Sweden has ratified both.

Article 192 of UNCLOS establishes a general obligation for states to protect and preserve the marine environment, and according to article 194 they shall take all measures necessary to comply with that obligation. This can be done individually, but there is also an obligation in article 197 to cooperate both regionally and globally. States shall provide scientific and technical assistance to developing states, as is laid down in articles 202–203, in order to ensure that they can comply with UNCLOS as well. Monitoring and environmental assessments shall be conducted (article 204–206), and states shall nationally, regionally, and globally adopt the necessary laws, regulations, guidelines, and other measures necessary and ensure enforcement of those in order to reduce any kind of pollution (articles 207–222). Article 237 refers to other conventions with respect to the protection and preservation of the marine environment, and the article states that specific obligations under such conventions should be carried out in a manner consistent with UNCLOS.

In measuring the overall fulfilment of SDG target 14.c on a global level, different indicators have been decided and suggested, such as “Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in UNCLOS, for the conservation and sustainable use of the oceans and their resources” by the United Nations Statistical Commission, UNSD, and “Participation rate in international marine agreements” as suggested in an article in the scientific journal *Earth’s Future*. This paper highlights Sweden’s progress by addressing a selection of actions taken by Sweden on the national, regional, and global levels, as part of its commitments in global or regional treaties, in an effort to take all measures necessary to protect and preserve the marine environment as required in UNCLOS.

National efforts

For more than 60 years, Sweden has developed national policies and regulations for a more sustainable use and protection of the environment. The result is that Sweden today has a robust legal system in the environmental area, with its broad-reaching Environmental Code that comprises most environmental areas and issues including those affecting the marine environment except from, most prominently, fisheries. New obligations arising from global and EU legislation are usually implemented through provisions in the Code and complemented by governmental ordinances and regulations issued by the specialized authorities. Governance is a key issue for Sweden to reach the sustainable development goals, from national to local administration and through management, regulation, enforcement, and control.

Examples

- The Swedish Agency for Marine and Water Management (SwAM) was created in 2011 to increase the integration of relevant policies to achieve a unified and coherent management of the aquatic resources in rivers, lakes and the sea.
- SwAM has decided on a programme of measure (PoM) for the implementation of the MSFD with 32 measures aiming at reaching good environmental status in the Baltic Sea and the North Sea, directed to other central environmental agencies, the county administrative boards and municipalities.
- In coastal waters Sweden has introduced regulation to protect and restore degraded marine habitats and populations. Bottom-trawling has been generally banned within 3-4 nm of the coastline, and almost 400 important fish spawning and migration areas have been defined, in which only hand-held fishing gear is allowed. For several species closed seasons and catch limitations have been introduced.
- The SwAM and the Swedish Board of Agriculture have jointly developed a strategy for Swedish commercial fishing aiming at use of the fish resource in an ecologically, socially and economically sustainable way, according to the CFP, the WFD, the MSFD and national legislation.
- To lessen the supply of hazardous substances and invasive alien species to the marine environment the Swedish Transport Agency is currently developing national guidance on hull cleaning and management of ship's biofouling.
- Compliance monitoring of Sulphur regulations has been a focus area for the Swedish Transport Agency and positive results of higher compliance has been shown.
- Measures, by means of legislation, have been taken to reduce discharge of sewage from ships, including from 2015 pleasure crafts, including facilitating reception facilities in ports.
- Sweden has introduced routing measures in the Baltic Sea as a measure for PSSA and, together with Denmark, a review process of existing routing measures is ongoing in Kattegat with the aim of avoiding environmental harm caused by grounding and accidents.
- Sweden has increasingly strengthened its legislation concerning mercury and since 1 June 2009 there is a general ban on using mercury in as well products as processes in Sweden.
- The EU Regulation on persistent organic pollutants (POPs) is the EU implementation of the Convention on Long-Range Transboundary Air Pollution, CLRTAP. In Sweden additional provisions have been introduced in the Swedish Environmental Code.
- The EU regulation on invasive alien species entered into force January 1 2015 as a response to the threats posed by such species on biodiversity and related ecosystem services. National specific regulations are adopted since 2017.
- Swedish legislation on ballast water, implementing the Ballast Water Convention, which Sweden has ratified, entered into force in 2017.
- Sweden has developed a framework for national programs of measures for marine threatened species and habitats to improve the status of those, addressing species and habitats listed as threatened in the EU's Birds and Habitats Directives, Regional Seas Conventions and national red lists.
- Sweden has already exceeded the Aichi target of 10 % marine protected areas (MPA) by 2020 when it comes to protected area. In the beginning of 2020 Sweden also

signed up to an international initiative to protect 30 % of the oceans by 2030, as considered in the development of a post-2020 global biodiversity framework under the Convention on Biological Diversity.

- Sweden has ratified the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits of the Convention on Biological Diversity. The protocol is implemented in Sweden by an EU-regulation and provisions in the Swedish Environmental Code.

Regional efforts

The sea and coastal areas are a continuum and do not stop at national borders, neither in terms of the ecosystems and biological diversity, nor when it comes to fishing and pollution. Sweden and neighbouring countries, with which we share our surrounding seas, have for decades developed joint planning for pollution reduction, marine protection and marine spatial planning. OSPAR, HELCOM, the Nordic Council of Ministers and the regional fisheries organisations are important tools for Sweden to build and respond to the global marine environmental processes and to coordinate the regional work. On the European level, the EU, has introduced several legal initiatives fostering marine protection, e.g. the EU Habitats directive, the WFD and the MSFD.

Examples

- Sweden has been active in influencing other Member States and the EU to impose the Common Fisheries Policy (CFP) in order to develop the collaborative work, i.e. between NEAFC or ICCAT with OSPAR, to secure the protection and sustainable management of living marine resources.
- After a joint recommendation from Sweden, Denmark and Germany, the EU Commission has introduced fisheries regulations in the marine protected area, MPA, of Bratten in Skagerrak. The regulation process was initialized by Sweden as an effort to protect vulnerable habitats on the sea-bottom in order to fulfil obligations under the Habitats directive, the MSFD and in relation to OSPAR.
- The status of the Baltic Sea is a priority issue for Sweden. The EU Strategy for the Baltic Sea Region it is an important tool to deepen cooperation between the countries around the Baltic Sea in order to meet the common challenges that countries in the region are facing today. The HELCOM Baltic Sea Action Plan (BSAP) is one of the major programmes to improve the marine environment.
- Sweden has taken an active role in the development of the legal framework and the designation of the Baltic Sea and the North Sea as Sulphur Emission Control Areas (SECAs). Sweden has also worked actively with North Sea and Baltic Sea countries to designate the area as a Nitrogen Emission Control Area (NECA). The requirements to remove the major part of ship's nitrogen oxides emissions is expected to take effect from 2021.
- Sweden is a signatory to several regional conventions and collaborates in associated commissions such as HELCOM and OSPAR. These commissions are important in the promotion of a holistic marine policy in the Baltic Sea and the North East Atlantic.
- Sweden has taken an active role in developing the OSPAR Regional Action Plan (RAP) for prevention and management of Marine Litter in the North-East Atlantic for the period 2014-2021. Sweden is responsible for two of the measures in this.

International efforts

The state of coastal waters and the seas is very serious. Ecosystems and thus the ocean's ecosystem services are adversely affected by, among other things, climate change, ocean acidification, mining and bottom trawling, marine litter and pollutants. The ocean's resilience and ability to absorb and break down nutrients and toxins, regulating the climate, etc. is deteriorating. Many fish stocks are decreasing drastically, and there is a risk that some species will become extinct. Pollution is an increasingly transboundary issue today something not least shown by the issue of marine litter and air-borne hazardous substances. Contributing to the process of sustainable seas requires cooperation across national borders and coherent action between several policy areas. Actions need to be taken by each country within their national jurisdiction.

Examples

- Sweden works in several global, international and regional organisations in order to, inter alia, strengthen the protection of marine environments, including in areas beyond national jurisdiction.
- Sweden undertakes bilateral cooperation to develop effective environmental administration for mutual strategic benefit such as implementation of commitments under international environmental conventions.
- The Common Fisheries Policy, CFP, including the external dimension, ensure in particular that EU fishing activities outside Union waters are based on the same principles and standards as those applicable under EU law in the area of the CFP. This is an important tool to strengthen the consistency of actions taken in the context of development cooperation.
- One example of development aid directly targeting SDG target 14.c is the aid to the UN Environment Africa marine and coastal programme. At the national level UN Environment has catalysed national policy processes through sustained awareness on topical issues including e.g. adoption and subsequent ratification of the additional protocol to the Abidjan Convention on land based sources and activities and preparation of the ICZM protocol to the Nairobi Convention. To keep the conventions operational and relevant have impacts nationally, regionally and internationally and supports the implementation of internationally agreed instruments.
- By means of Swedish financial support to the Global environmental fund, GEF, Sweden contributes to the funds contribution to the developing countries fulfilment of the SDG goal 14. As a substantial contributor to GEF, Sweden has good possibilities to influence the fund's priorities.
- EU and Sweden played an active role in negotiations for the global Minamata Convention on Mercury, who went into force in 2017. The Swedish ambition was to ensure that it remained possible for member states like Sweden to have or to keep existing higher levels of protection.
- Sweden is fully committed to the effective implementation and further development of the Stockholm Convention on Persistent Organic Pollutants.
- Sweden is a party to the majority of the IMO Conventions, including the important MARPOL and SOLAS Conventions. In addition to protecting the environment from emission related to shipping activities, safe construction and operation of ships will also have a positive impact on the marine environment.
- Sweden has a good record of reporting on its obligations under conventions.

- The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) is seen as an example of best practice in managing marine resources in international waters. In 2016 the Ross Sea MPA (the world's largest with its 1,6 million km²) was created. Sweden, member of CCAMLR, actively supported this MPA proposal.

Challenges and Gaps

- The legal framework for the ocean is complex and its effective implementation will have a critical impact on progress in all target areas of SDG14.
- The way international cooperation will manage handling transboundary pollution will be of great importance to the health of the oceans. The Convention on Long-Range Transboundary Air Pollution, CLRTAP, this far has only 51 parties.
- The implementation of environmental policy and legislation and other environmental measures is often quite weak in many developing and transitional countries, often related to environmental institutions with weak capacity, lacking political support and financial resources.
- At the regional level, a number of instruments (such as regional seas conventions and regional fisheries management organisations and arrangements) complement the global ones. The coordination and coherence among those is a key issue for ocean governance and the experiences vary considerably. Of importance in this process is a well-functioning national public administration that coordinates its various positions across the respective areas of expertise.
- The fact that most countries could agree to begin negotiations on an implementing agreement to the UNCLOS for the protection of marine biodiversity in areas beyond the jurisdiction of any state is evidence of the realisation of the importance of long-term sustainable ocean management. The challenge will be to reach an agreement that will sufficiently protect biodiversity from negative impacts from, in some cases, yet unknown activities.
- There is a challenge to create a system that incorporates non-legally binding documents such as for example the OSPAR recommendations for threatened species and habitats in the existing legal and/or implementing framework to assure their national impact.
- There are areas where legal gaps in the international framework constitute the main challenge for sustainable management of the oceans. Most evidently, areas beyond national jurisdiction remain with limited rules, although not entirely unregulated. The ongoing negotiations for a new implementation agreement for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction under UNCLOS will be able to close some important regulatory gaps. It is of high importance to find modalities for collective arrangements between the regional and global levels such as between OSPAR and IMO or the International Seabed Authority (ISA). Failure

to address the issue in one sector might make actions taken in other sectors superfluous.

- The lack of efficiency in international ocean governance is often due to poor implementation of existing frameworks and obligations in international law and also of absence of domestic regulations. Improving domestic regulations and implementation ought to be the top priority in any endeavour to improve international ocean governance.
- There is a need to further develop the national monitoring to better answer to the Swedish obligations in regard of the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD).
- There is also a need for further integration between environmental and sectoral legislation.
- Implementation of legal requirements to take ecosystem considerations into account in decision-making regarding the marine environment is necessary to implement ecosystem-based management.
- The application of environmental quality standards needs to be ensured, also in situation when there is a lack of a permit requirement.
- The coherency, ecological representatively and functionality of the marine protected areas (MPAs) network need to be improved.
- To increase the functionality of MPAs, in particular restrictions on fisheries with negative impact on the environment, MPAs must be adopted and the protection of coastal habitats strengthened.
- Cumulative effects must be taking into account in decision-making to a greater extent.
- There is also a need for better, easier and comparable (open) access data for implementation and monitoring of sustainable development and research. Since open data improves the availability, comparability and transparency of data, which in turn leads to commitment, innovation, better knowledge and decision-making, it is important that these various partnerships fully support the implementation of Agenda 2030 in an effective manner.