

# **Building momentum to accelerate adoption of source-to-sea management**



Lessons learned and recommendations from seven case studies



**Swedish Agency  
for Marine and  
Water Management**

# Building momentum to accelerate adoption of source-to-sea management

## Lessons learned and recommendations from seven case studies

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# Preface

This report is a synthesis of seven case studies on source to sea management. The objective is to explore incentives and guidance to accelerate sustainable development outcomes from source to sea. The report provides recommendations on source to sea implementation based on lessons learned from seven case studies. These recommendations are of value for actors interested in implementing the source-to-sea concept or for those actors that want to augment their ongoing practice with a more holistic management approach from source to sea.

The report is commissioned by the Swedish Agency for Marine and Water Management (SwAM) and written by the Stockholm International Water Institute (SIWI).

Traditionally, governance frameworks such as policies and regulations are often fragmented and directed towards maximizing local benefits for individual segments or sectors with no or little consideration on the linkages between land, freshwater, coasts and the ocean. Such governance frameworks often result in actions and outcomes that may not be optimal in producing ecosystem services in interconnected systems. Source-to-sea management can contribute to overcoming such fragmented land, water and marine management by introducing a more holistic approach that considers environmental, social and economic linkages across the source-to-sea continuum thereby stimulating coordinated action across sectors and segments for sustainable development outcomes.

The report concludes that the source-to-sea approach will be more effective when it is anchored in existing or necessary decision-making processes. The variations in the local contexts from the seven case studies brought to light that there is a progression of readiness in governance to achieve management from source-to-sea. These levels of readiness range from stakeholders being newly introduced to the benefits of a source-to-sea system approach to management to well-developed stakeholder engagement and coordination processes that more quickly can take advantage of the approach. The approach helps to bring people together and motivate participation in coordinated management of interconnected source to sea systems. A main driver for the uptake of source-to-sea management is clear development outcomes such as in restoring river and coastal ecosystems, climate change adaptation and mitigation, increased biodiversity, ocean health, and poverty alleviation along the source to sea continuum.

The report is a result of the Swedish international bilateral cooperation programme on environment and climate change, funded by the Swedish government and implemented by SwAM. SwAM is the responsible Swedish government agency tasked with protecting, restoring and ensuring sustainable use of freshwater and ocean resources, including fisheries management and control. Since its establishment in 2011, the agency has in partnership with central, regional, and local government authorities been striving for a more holistic approach to marine and freshwater management in Sweden and globally. A governance framework that promotes ecosystem management related to both freshwater and marine water resources supports this approach.

Jakob Granit  
Director General, Swedish Agency for Marine and Water Management

# Summary

The analysis of the seven cases presented in this report has been useful for understanding the opportunities and challenges for implementing source-to-sea management. It has also provided insights into the strengths and limitations of the six-step source-to-sea approach. While there was not a case that has completed the entire six-steps of the source-to-sea approach or demonstrated measurable benefits to the source-to-sea system from implementing priority actions, the cases do provide sufficient evidence that there is added value in applying the six-step source-to-sea approach to address source-to-sea challenges.

The analysis of the cases has shown that while the six-step source-to-sea approach is relatively new it will continue to evolve as it is applied in more locations and to address a range of sustainable development challenges. Given the value that can come from holistic management of source-to-sea systems, investment in such development appears to be well founded. This investment will reap benefits by unlocking the barriers to implementing source-to-sea management. In the first instance, investment should be made in building up a larger library of cases that will demonstrate the benefits of source-to-sea management. Beyond this, several areas would be particularly informative and supportive of reaching the goal of managing land, freshwater, coastal, and marine environments from source to sea.

Diverse and inclusive partnerships that build on the collective and individual strengths of multilateral agencies, financing institutions, national and sub-national governments, regional entities, non-governmental organizations, research institutions, and private sector are needed for holistic management of land, freshwater, coastal and marine resources to take hold. Collecting and sharing a library of cases and lessons learned through these partnerships can benefit those who are hesitant to embark on applying the source-to-sea approach or are resistant to source-to-sea management because they are unsure of how it works or the benefits it can offer. Real world examples will demystify what is intended and confirm that taking steps toward source-to-sea management is pragmatic when facing source-to-sea challenges. This exchange can improve understanding of key bottlenecks to source-to-sea management and the potential avenues for addressing them.

Enhancement of the knowledge of the linkages in the biophysical, social (stakeholder), and governance systems is a requisite for holistic management of source-to-sea systems. Research needs to be directed toward areas that can be used to inform science-based policies, management, and investments that create benefits for the whole source-to-sea system. Data collection, analysis, and monitoring need to be done in a manner that provides a coherent view of the source-to-sea system and enables tracking of source-to-sea impacts and benefits. Funding programmes for research should include research topics that address critical knowledge gaps on source-to-sea linkages in the biophysical, social (stakeholders), and governance systems.

Commitment to incorporate source-to-sea perspectives into prominent global, regional, and national policy processes can arise through the elaboration of the opportunities offered by source-to-sea management to address key global challenge areas of priority to countries, including climate adaptation/mitigation, biodiversity conservation, pollution, and poverty alleviation. Issues tackled at these higher levels of policy development can guide actions to be taken at local levels. Similarly, experiences at the local level, drawing from the local context and

its priorities can feed into the design of national, regional, and global agendas and tracking mechanisms. Clarifying what is required in the enabling environment for source-to-sea management in dialogue with regional, national, and sub-national actors and investing in these can strengthen the impact of global commitments.

To follow up on these commitments, there must be finance mechanisms and enabling environments that incentivize investment in measures that result in optimal outcomes for the source-to-sea system. Addressing development challenges requires finance that is not limited by economic borders, specific sectors, or social geographies and includes assessment of risks and benefits across the source-to-sea continuum, evaluates trade-offs, and fosters new forms of collaboration. Funding strategies need to go beyond the often sector-specific objectives to enable financing of cross-sectoral and system-wide actions. Eliciting commitments from financial institutions to review investments with a source-to-sea lens is crucial for accelerating the adoption of source-to-sea management and could help shape interventions that tackle key development challenges in a more holistic manner.

Capacity development among public, private, and civil society actors to address upstream-downstream linkages and facilitate cross-sectoral coordination will increase local, national, and regional expertise and spur movement toward source-to-sea management. Guidance on the application of the six-steps source-to-sea approach in diverse settings and in response to key development challenges can strengthen the application of the source-to-sea approach and support its application to new issues and contexts. Having these materials would support capacity development efforts of regional, national, and local stakeholders. Training programmes can target specific source-to-sea challenges, as well as particular contexts or perspectives for those challenges. They can also be modified to match the current source-to-sea management level and support movement along the readiness continuum.

Finally, concrete steps to address development challenges through projects, policy, strategy, planning, or other decision-making processes using the source-to-sea approach should be taken. The source-to-sea approach can be applied to develop a shared understanding of a source-to-sea challenge, come to agreement on a vision for the desired future and design a theory of change that proposes the conditions for success. This can then lead to establishing the enabling environment and achieving the desired changes in behavior and practices needed to achieve the desired future. Each time a development challenge is addressed by accounting for source-to-sea linkages and aiming toward holistic source-to-sea management, new lessons will be learned. Through monitoring and evaluation, the evidence base will grow, which can then be used in raising awareness of the benefits of addressing source-to-sea linkages through holistic management thereby building a momentum in the adoption of source-to-sea management.

## Svensk sammanfattning/ Swedish summary

Analysen av de sju fallstudier som presenteras i denna rapport har varit användbar för att förstå möjligheterna och utmaningarna vid implementeringen av källa-till-havs-förvaltning. Den har också gett insikter om de styrkor och begränsningar som den sex-steps källa-till-hav-metoden inbegriper. Även om ingen utav de sju studier har slutfört hela sex stegen i källa-till-hav-metoden, eller visat mätbara fördelar för källa-till-hav-systemet, ger fallstudierna tillräckliga bevis för att det finns ett mervärde att tillämpa sex-steps källa-till-hav-metoden för att ta itu med utmaningar för hållbar utveckling från källa till hav.

Även om metoden är relativt ny kommer den att fortsätta utvecklas när den tillämpas på fler platser och tar itu med fler utmaningar. Med tanke på värdet som kan komma från holistisk förvaltning av källa-till-havs-system, verkar investeringar och insatser i sådan utveckling vara välgrundade. I första hand bör investeringar och insatser göras i att bygga upp ett större antal av fall som kan visa på fördelarna med holistisk förvaltning från källa till hav. Utöver detta har fler insatsområden identifierats för att nå målet att hantera land-, sötvatten-, kust- och havsmiljöer holistiskt från källa till hav.

Inkluderande partnerskap som bygger på de kollektiva och individuella styrkorna hos multilaterala organisationer, finansiella institutioner, myndigheter, icke-statliga organisationer, forskningsinstitutioner och privat sektor behövs för att holistisk förvaltning från källa till hav ska få fäste. Att samla in och dela praktiska exempel och lärdomar från dessa partnerskap kan gynna dem som är tveksamma till att börja tillämpa källan-till-havs-metoden på grund av osäkerheter kring hur det fungerar eller fördelar den kan erbjuda. Praktiska exempel från källa-till-havs förvaltningen har möjligheten att belysa metodens funktionella värde när utmaningar uppstår inom ett källa-till-hav system. En starkt kunskapsbas med praktiska exempel skulle kunna öka förståelsen för viktiga flaskhalsar inom källa-till-hav-förvaltning och potentiella lösningar för att åtgärda dem.

En ökad förståelse om kopplingarna mellan ekosystem, socioekonomiska intressenter och förvaltningssystem är en förutsättning för holistisk förvaltning från källa till hav. Forskningen behöver fokusera på de frågorna som ger stöd till mer vetenskapsbaserad policy, förvaltning och investeringar som skapar nytta för hela källa-till-hav-systemet. Datainsamling, analys och övervakning behöver göras på ett sätt som ger en sammanhängande bild av hela källa-till-hav-systemet och möjliggör spårning av källa-till-hav effekter. Finansieringsprogram för forskning bör också omfatta forskningsområden som tar itu med kritiska kunskapsluckor om källa-till-hav kopplingar i ekosystem och förvaltningssystem.

Engagemang för att integrera ett källa-till-hav-perspektiv i framstående globala, regionala och nationella policyprocesser behöver stärkas. Detta kan uppnås genom ökad kunskap och förståelse om möjligheter som erbjuds av källa-till-hav förvaltning för att ta itu med globala utvecklingsutmaningar såsom klimatanpassning/ begränsning, bevarande av biologisk mångfald, föroreningar och fattigdomsbekämpning. Policyutveckling på högnivå inom dessa frågor kan vägleda åtgärder som vidtas på lokal nivå. På liknande sätt kan erfarenheter på lokal nivå, med utgångspunkt i den lokala kontexten och dess prioriteringar, bidra till utformningen av nationella, regionala och globala agendor. Att klargöra vad som krävs för att skapa möjliggörande miljön för

källa-till-hav förvaltning i dialog med regionala, nationella och subnationella aktörer och investera i dessa kan stärka effekterna av globala engagemang för källa-till-hav förvaltning.

Det globala engagemanget behöver följas upp med finansieringsmekanismer och möjliggörande miljöer som stimulerar investeringar i åtgärder som optimerar utfallet i hela källa-till-hav systemet. Att ta itu med utvecklingsutmaningar kräver finansiering som inte begränsas av ekonomiska, sektoriella och sociala gränser. Det behövs också en mer holistisk bedömning av risker och nytta över hela källa-till-hav kontinuumet som avväger och främjar nya former av samarbete. Finansieringsstrategier bör inte begränsas av sektorspecifika mål för att möjliggöra finansiering av tvärspektoriella och systemövergripande åtgärder. Det är också viktigt att finansiella institutioner åtar sig att granska sina investeringar genom ett källa-till-hav-perspektiv. Detta är en central komponent för att snabba på implementering av källa-till-hav förvaltning, vilket kan bidra till att utforma insatser som adresserar kritiska utvecklingsutmaningar på ett mer integrerat och holistiskt sätt.

För att stärka kompetensen på lokal, nationell och regional nivå och främja implementering av källa-till-hav förvaltning, är det avgörande att utveckla kapaciteten hos aktörer inom offentlig sektor, näringsliv och civilsamhälle. Genom att erbjuda vägledning om hur den sex-steps källa-till-hav metoden kan tillämpas i olika miljöer och utvecklingsutmaningar, kan vi inte bara stärka dess implementering, utan också underlätta anpassningen av metoden till nya problem och sammanhang. Att ha tydlig vägledning skulle stödja kapacitetsutvecklingsinsatser för regionala, nationella och lokala intressenter. Utbildningsprogram kan riktas mot specifika källa-till-hav utmaningar, såväl som särskilda sammanhang eller perspektiv för dessa utmaningar. De kan också anpassas till det befintliga förvaltningssystemet för att skapa bästa förutsättningar för en utveckling mot en mer holistisk förvaltning från källa till hav.

Slutligen, fler konkreta insatser för att adressera olika utvecklingsutmaningar där källa-till-hav kopplingarna beaktas bör genomföras genom projekt, policy och strategier. Den sex-steps källa-till-hav metoden kan tillämpas för att utveckla en gemensam förståelse för olika utmaningar i ett källa-till-hav system, en gemensam vision för framtiden och en förändringsteori som framhåller nödvändiga förutsättningarna för framgång. Detta kan i sin tur bidra till att etablera en gynnsam miljö som möjliggör de nödvändiga förändringarna i beteende och praxis för att nå den eftersträfvade framtiden. Varje gång en utvecklingsutmaning hanteras genom att integrera ett holistiskt källa-till-hav perspektiv kommer nya lärdomar att dras. Genom uppföljning och utvärdering kommer evidensbasen att växa vilket sedan kan användas för att öka medvetenheten om fördelarna med att hantera källa-till-hav kopplingarna på ett holistiskt sätt och därigenom bygga upp starkare momentum för implementering av källa-till-hav förvaltning.

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# 1. Introduction

Following the publication of *Implementing the source-to-sea approach: A guide for practitioners* (Mathews et al., 2019), the Swedish Agency for Marine and Water Management (SwAM) commissioned five studies applying the source-to-sea approach to an array of locations, contexts and issues. Additionally, the Stockholm International Water Institute (SIWI) piloted the source-to-sea approach in two other locations as part of the *Foundations for Source-to-Sea Management* project funded by German Federal Ministry of Economic Cooperation and Development (BMZ): Lake Hawassa Sub-basin in the Rift Valley Lakes region of Ethiopia and Vu Gia-Thu Bon River Basin, in central Viet Nam.

This report looks at these seven cases in Europe, Asia and Africa, which represent the first efforts of applying the six-step source-to-sea approach as presented in Mathews et al., 2019 and Mathews and Stretz, 2019. This approach provides a six-step structured process to identify appropriate courses of action with the goal of supporting adoption and implementation of source-to-sea management.

## 1.1 Source-to-sea studies and pilots

The six-step source-to-sea approach was applied in seven cases with a diverse set of contexts and questions and ranged in the application of the source-to-sea approach from desk studies to projects that included field assessments and regular interaction with local stakeholders. As these were preliminary, short-term studies and pilots, the focus was on testing a variety of applications of the source-to-sea approach and building the knowledge base from a source-to-sea perspective. All combined, these seven cases provide the basis for an initial analysis of the application of the source-to-sea approach, its strengths and limitations and the opportunities and challenges for implementing source-to-sea management.

The five studies commissioned by SwAM are:

1. The Bohai and Baltic Seas from a Source-to-Sea Management Perspective (2020)
2. Luga River and Bay in a Source-to-Sea Management Perspective (2020)
3. Source-to-Sea Screening study of pollution and flows in KwaZulu-Natal, South Africa (HaV, 2019)
4. Source-to-Sea Management of Göta River - Historical Perspective (2021)
5. Source-to-Sea metoden applicerad på material (från båtliv) och biota (fisk) (in English: The Source-to-Sea method applied to materials (from boating) and biota (fish)) (Nordzell et al, 2020) referred to as 'Three Archipelagos' in this report.

Four of these were undertaken as part of their international cooperation and feed into ongoing processes in each location. The Bohai and Baltic Seas report contributes to the China Europe Water Platform dialogue. The Luga River and Bay (Russia) focuses on salmon recovery and reduction of nutrient pollution and actions that can contribute to the Baltic Sea Action Plan. The study in KwaZulu-Natal supports the Department of Forestry, Fisheries and the Environment (DFFE) in action planning related to plastic waste and other pollution entering rivers. The study of biota and boating is part of a broader project for the *Three Archipelagos* (Source-to-Sea metoden

applicerad på material (från båtliv) och biota (fisk) and in English: The Source-to-Sea method applied to materials (from boating) and biota (fish)) undertaken by the Swedish Maritime Agency. Finally, the Göta River study applied the source-to-sea approach to a retrospective analysis of enabling conditions for addressing pollution flows.

The two pilots conducted by SIWI in the *Foundations for Source-to-Sea Management* project are:

1. Piloting the Source-to-Sea Approach in the Lake Hawassa Sub-Basin (SIWI, 2020a)
2. Piloting the Source-to-Sea Approach in the Vu Gia-Thu Bon River Basin (SIWI, 2020b)

These two pilots were focused on the first three steps of the source-to-sea approach that aimed to:

- increase knowledge of prioritized local challenges constraining sustainable development;
- strengthen awareness of the linkages between upstream and downstream activities and their impacts;
- highlight the opportunities and challenges associated with implementing the source-to-sea approach to management; and
- develop local capacity to take a holistic approach to natural resource management and economic development.

While the two pilots were cut short by the Covid-19 pandemic, there are still significant learnings to harvest from the work that was completed.

Table 1: Overview of the seven source-to-sea studies and pilots included in this report.

	<b>Bohai-Baltic Seas</b>	<b>Luga River and Bay</b>	<b>KwaZulu-Natal</b>	<b>Göta River</b>	<b>Three Archipelagos</b>	<b>Lake Hawassa Sub-basin</b>	<b>Vu Gia-Thu Bon River Basin</b>
<b>Type of project</b>	Desk study	Desk study & 2 stakeholder workshops (2020)	Desk study, expert and stakeholder interviews	Desk study	Desk study	On-the ground project	On-the-ground project
<b>Country/Region</b>	China/Baltic Sea Region (14 countries)	Russia	South Africa	Sweden	Sweden, Finland	Ethiopia	Viet Nam
<b>Ongoing processes the study/pilot contributes to</b>	Feed into dialogue in the China Europe Water Platform	Support to the Baltic Sea Action Plan and bi-lateral cooperation on salmon recovery and reduction in nutrient pollution	Support to Department of Forestry, Fisheries and Environment in promoting investment by local governments in pollution control	Historical review to identify success factors in non-point source pollution prevention	Analysis of boating and fishing impacts in transboundary archipelago as part of larger project	Contribution to the development of the Strategic IWRM plan for Ethiopian Rift Valley Lakes Basin 2020-2035	Plastic waste and source-to-sea approach identified as priority by the Interprovincial Joint Coordination Committee (Da Nang and Quang Nam provinces)
<b>Size of source-to-sea system</b>	Bohai Sea catchment area 1.3 million km <sup>2</sup> (Hai He River Basin area 320,000 km <sup>2</sup> ); Baltic Sea catchment area 1.7 million km <sup>2</sup> (Northern Baltic Sea Water District area 37,000 km <sup>2</sup> )	Luga River catchment area 13,600 km <sup>2</sup>	uMngeni catchment area 4,432 km <sup>2</sup> ; KwaZulu-Natal province area 94,361 km <sup>2</sup>	Göta River catchment area 50,200 km <sup>2</sup>	3 archipelagos within the Baltic Sea catchment area of 1.7 million km <sup>2</sup>	Lake Hawassa Sub-basin area 1400 km <sup>2</sup>	Vu Gia-Thu Bon River Basin area 10,350 km <sup>2</sup>
<b>Source-to-sea steps covered</b>	1-4	1-4	1-4	1-4	1-4	1-3	1-3
<b>Priority source-to-sea flows assessed</b>	Plastic waste, Nutrient pollution (Nitrogen/Phosphorus), Hydropower (and its impacts on sediment and biota)	Wild Salmon, Nutrient pollution (Nitrogen/Phosphorus)	Solid waste/ plastic waste	Pollutants: Nitrogen, Phosphorus, Mercury; Materials: Hydropower and fish	Materials (boating): Biota (fish)	Sediment erosion; plastic waste	Plastic waste

## 1.2 Structure of the report

This report is composed of three parts:

1. It starts by exploring key components of applying the source-to-sea approach and presents examples from the seven cases to better illustrate these points.
2. This is followed by reflections on the opportunities and challenges in implementing source-to-sea management and insights on the strengths and limitations of the source-to-sea approach. These reflections and insights are gathered from the analysis of the seven cases, from interviews of practitioners who applied the source-to-sea approach in these seven cases and from discussions held at a workshop co-convened by SwAM, the Action Platform for Source-to-Sea Management and SIWI.
3. It concludes with recommendations on how to build momentum toward broader adoption of source-to-sea management.

A summary of each of the studies in terms of their purpose, structure, geographical focus, thematic focus and key findings and assessment of the application of the source-to-sea approach is provided in the Annex.

## 2. What is source-to-sea?

### 2.1 Source-to-sea system

A source-to-sea system is the land area that is drained by a river system, its lakes and tributaries (the river basin), connected aquifers and downstream recipients including deltas and estuaries, coastlines and near-shore waters, the adjoining sea and continental shelf as well as the open ocean. A source-to-sea system can also be defined at a larger scale to include a sea and its entire drainage area, which may include several river basins.

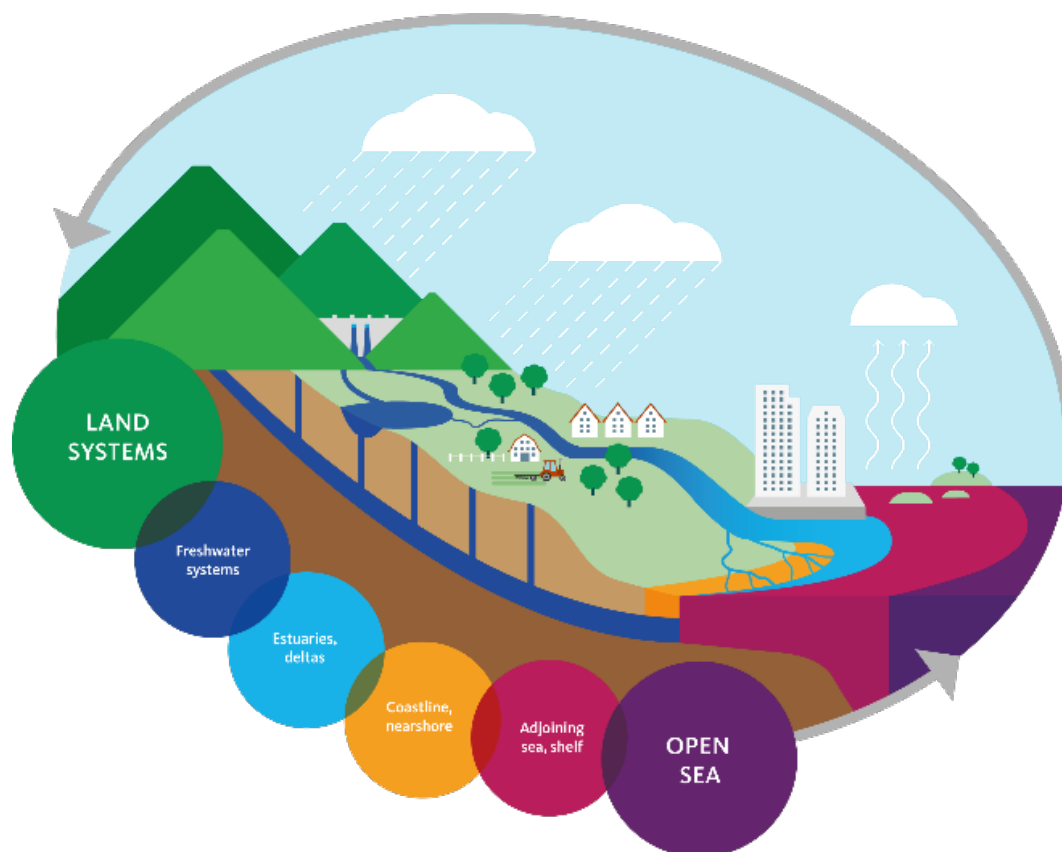


Figure 1: A source-to-sea system. Source: Stockholm International Water Institute (SIWI)

### 2.2 The source-to-sea concept

The source-to-sea concept defines key flows found within a source-to-sea system; describes six steps to guide analysis and planning; and presents a framework for elaborating a theory of change - all with an aim of designing initiatives that support healthy ecosystems and sustainable green and blue economies. The source-to-sea concept identifies six key flows that connect the source-to-sea system from: water, sediment, pollutants, biota, materials and ecosystem services.

### 2.3 The source-to-sea approach

The six-step source-to-sea approach directly addresses the linkages between land, water, delta, estuary, coast, nearshore and ocean ecosystems contributing to a more holistic natural resources management and economic development.

This approach provides a structured process to be undertaken in the design, planning, implementation and evaluation of strategies, policies, plans, projects and programmes with the goal of supporting source-to-sea management. It is intended to be a relatively fast and flexible approach that builds on an existing baseline of governance, planning and management. Thus, it can look different in different locations. The intended outcome of the source-to-sea approach is to identify appropriate courses of action to address alterations of key flows, contributing to economic, social and environmental benefits.

The approach includes six steps (Figure 2), through which linkages between source-to-sea segments and sectors are considered in order to identify and prioritize issues to be addressed across the source-to-sea system. The approach begins with understanding the pressures and drivers of altered key flows (Step 1: CHARACTERIZE). This, in combination with selecting an appropriate scale of intervention, engagement of stakeholders (both upstream and downstream) (Step 2: ENGAGE) and a thorough understanding of the governance context (Step 3: DIAGNOSE) sets the basis for defining a theory of change (Step 4: DESIGN) to guide planning and implementation (Step 5: ACT). Monitoring and adaptive management round out the process (Step 6: ADAPT) and can be used to refine the theory of change and ensure continuous improvement toward long-term outcomes.

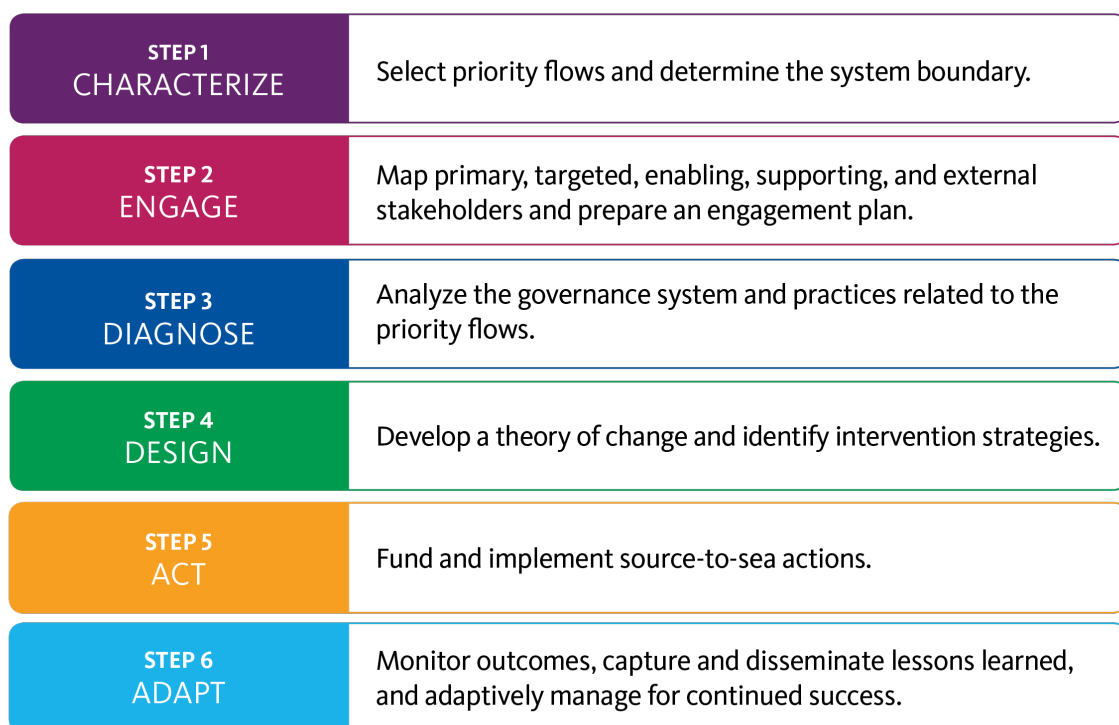


Figure 2: Six steps of the source-to-sea approach (Source: Mathews et al., 2019)

## 2.4 Why is source-to-sea management needed?

Traditional governance frameworks are often structured around individual segments of a source-to-sea system and/or focused on one sector. This can make them poorly suited to manage challenges that require approaches to address the source-to-sea system as a whole. Resource

management tends to also be dealt with segment by segment, or sector by sector, resulting in outcomes that may or may not be optimal for the entire source-to-sea system.

Practices, following in line with the segmentation of policies, procedures and regulations, are often directed toward maximising local benefits and are blind to their upstream and/or downstream impacts. This can result in benefits for one sector, or in one source-to-sea segment, having negative consequences on another. These consequences are often not adequately accounted for in decisions about governance and practice.

## 2.5 Source-to-sea management

Source-to-sea management can combat this by widening the perspective to include upstream and downstream linkages. Source-to-sea management considers the entire source-to-sea system – stressing upstream and downstream environmental, social and economic linkages and stimulating coordination across sectors and segments. Such source-to-sea management should be:

- **Holistic** – addressing upstream and downstream linkages across issues, stakeholders, desired outcomes, costs and benefits
- **Collaborative** – building upon existing institutions, established methods and ongoing processes
- **Prioritizing** – targeting and addressing the issues that hold the greatest potential for generating positive impacts for the system
- **Participatory** – engaging upstream and downstream stakeholders from different sectors and raising awareness about the impact of human activities
- **Context dependent** – derived from, and responsive to, the local context
- **Result oriented** – targeting intermediate outcomes that contribute to overall improved economic, social and environmental status
- **Adaptive** – learning-by-doing through pragmatic implementation, monitoring, evaluation and adaptive management

## 3. Applying the source-to-sea approach: highlights from the seven case studies

This report reflects on the five studies commissioned by SwAM and the two pilots conducted by SIWI, which together cover an array of applications of the source-to-sea approach (Figure 2). As shown in Table 1, the cases cover a range of countries in Europe, Africa and Asia, a breadth of catchment sizes from 1400 km<sup>2</sup> to 1.7 million km<sup>2</sup> and a variety of priority source-to-sea flows: pollution (nitrogen, phosphorus, mercury, plastic waste), materials (hydropower and boats), sediment, biota (salmon and other fish species). They also contributed to different ongoing processes, such as the China Europe Water Platform (CEWP), the Baltic Marine Environment Protection Commission (HELCOM) Baltic Sea Action Plan and support the work of the Department of Forestry, Fisheries and Environment in South Africa.



The two pilots differ from the studies assessed in this report in that they included on-the-ground activities that engaged stakeholders in using the source-to-sea approach in relation to critical local issues of concern. Workshops were held with interactive exercises for stakeholders, and training in the source-to-sea approach was provided as part of capacity development for source-to-sea management.

For the source-to-sea approach to be an effective tool, there must first be the identification of a source-to-sea challenge that needs to be addressed in a way that extends beyond the usual spatial or sectoral silos that actors generally operate within. Anchoring the application of the source-to-sea approach in already existing processes can provide a context for its application and strengthen the outcomes of the existing process. The readiness level for implementing source-to-sea management can dictate the way that the source-to-sea approach is implemented and the objectives of this implementation. Each of the steps of the source-to-sea approach also need to be adapted to the local context, the existing information, levels of awareness, capacity and resources available. The following sections provide examples of the source-to-sea challenges, existing processes, readiness levels and implementation of the steps from the seven cases.

### 3.1 Source-to-sea challenges

A first step in applying the source-to-sea approach is realizing that a source-to-sea challenge is being faced. Such challenges arise when activities in one part of the source-to-sea system alter one or more source-to-sea flows (water sediment, biota, pollution, materials and ecosystem services) in a way that impacts occur in another location in the source-to-sea system, either upstream or downstream of the activity generating the alterations. Source-to-sea challenges cannot be addressed in isolation where the impact is being felt and must include actions outside the locality, sometimes hundreds or even thousands of kilometres away. Identifying the source-to-sea challenge provides the motivation for initiating the steps of the source-to-sea approach that will lead to coordinated management of the source-to-sea system. Several examples of source-to-sea challenges are given below.

- **Bohai-Baltic Seas:** The Bohai and Baltic Seas are both isolated, shallow seas with slow exchange of waters with outer seas. Some of the pressures on these seas are exacerbated by the limited level of water exchange; for example, nutrients and other substances from the drainage area accumulate in the seas and are only diluted slowly. Addressing these inputs to the enclosed waters of these seas can only be done by working upstream in their respective drainage areas. Hydropower dams in rivers draining to these two seas alter river flows and importantly reduce sediment flows to downstream deltas and coasts.
- **Luga River and Bay:** The Luga River, together with the Gladyshevka, is the only Russian river with a river mouth in the Gulf of Finland that still holds a wild and natural reproducing population of Atlantic salmon (*Salmo salar*). The salmon have been important for commercial fishing but habitat degradation and changes in the hydrological regime due to shallowing of the river and destruction of the natural bottom substrate are factors that have had negative effects on the status of the salmon population. Poaching and illegal fishing is a severe problem in the Luga River. The river also contributes high loads of nitrogen and phosphorus to the Baltic Sea. Large scale livestock farming and agriculture in the upper parts of the basin result in high levels of nitrate in surface waters and in the shallow groundwater aquifers, which affects people using individual or small-scale water supply systems. In the lower parts of the basin, fertilizer production, landfills

and lack of municipal wastewater treatment are important sources of nutrient pollutants. Extensive draining of wetlands in the basin during the 20th century has resulted in lower natural nutrient retention.

- **KwaZulu-Natal:** Litter, mainly plastics, is found on beaches all along the coast and regular beach-cleaning is needed to keep the beach attractive to visitors. There are reports of over thirty species of fish (30,000 individuals in total) having been found entangled and/or with plastics ingested in KwaZulu-Natal over the last decades. The coastal and marine resources are under considerable stress from human activities and the ecosystem is severely degraded in many areas. The natural coastal environment in KwaZulu-Natal is highly influenced by human settlements and various upstream activities including agriculture, grazing of cattle, urban development including smaller and larger industrial activities. Additionally, Durban Bay is heavily polluted, and the high degree of human activity in the area means the bay is affected by sewage, pathogenic pollution, waste material and litter including plastics, industrial wastewater, cooling water, silt and sediment. Several well-documented cases of fish deaths within the harbour and bay can be attributed to the polluted state of the estuary; a large part of the Bay is today completely lacking higher life in the seabed and only the most tolerant fish species can survive near the surface in these areas.
- **Göta River:** The environmental problems observed in the Göta River catchment and its coastal waters are strongly linked to its industrialisation and exploitation of the river for hydroelectricity. The pollution of lakes and rivers due to the emission of untreated wastewater from industry and settlements led to the destruction of habitats, regular fish deaths and even threatened the drinking water supply in the catchment. The problems caused by the nutrients phosphorus and nitrogen and mercury contained in these wastewaters were particularly pronounced and caused eutrophication in rivers, lakes and the coastal waters with negative impacts on flora, fauna and water quality. Mercury emissions from industrial wastewaters and from agricultural seeds caused bird deaths and accumulated in fish thereby rendering these fish unsuitable for consumption and endangering human health. The regulation of rivers and Lake Vänern for hydropower production caused a loss of connectivity and habitats, a reduction in the sizes of fish populations and a change in the composition of fish populations.
- **Lake Hawassa Sub-basin:** Lake Hawassa is 90 km<sup>2</sup> in size and is the endpoint of an endorheic hydrological system, with some limited groundwater outflow. With as much as 750 km of eroded gullies in the sub-basin, erosion and sediment flows into Lake Hawassa is one of its greatest threats. Erosion has increased dramatically, largely due to expansion of agriculture in upland areas over the past 50 years and sand mining in lowland areas draining into the lake. This has resulted in the loss of neighbouring Lake Cheleleka and filling of Lake Hawassa. With no outlet, once sediment enters the lake, it resides there indefinitely.
- **Vu Gia-Thu Bon River Basin:** The Vu Gia-Thu Bon basin has short, steep watersheds with highly variable seasonal flow, which results in rapid runoff events that can carry solid waste deposited in land areas near waterways from the upper to lower basin quickly. While urban centres generate an estimated 206 tonnes per day of plastic waste, they also have higher levels of waste collection and management services. On the other hand, rural areas generate fewer tonnes of plastic waste per day but a much higher percentage is unmanaged, allowing it to be swept into rivers and out to sea. Likewise, about one quarter of plastic waste is unmanaged in coastal areas, which are the most vulnerable to leaking plastic to the sea. Tourism is an important economic activity most particularly in Hoi An and Da Nang and along the coast and Cu Lao Cham Islands. While solid waste management and recycling levels are high in these two urban centres, much of the plastic waste is coming from outside these areas.

## 3.2 Anchoring the source-to-sea approach

In the five studies and two pilots, the application of the source-to-sea approach contributed to ongoing dialogue processes that provided a venue through which the knowledge developed could be shared and engagement of stakeholders occurred. These processes ranged from broad transboundary cooperation to basin planning and provincial priority-setting.

- **Bohai-Baltic Seas:** This study has been part of China Europe Water Platform's Horizontal Actions, with the long-term purpose to contribute to a more integrated and holistic water and marine management, alleviating the burden on water-related ecosystems and improving economic opportunities and livelihoods. The aim of the study was to develop an initial knowledge base on opportunities and challenges for source-to-sea management in the Baltic and Bohai Seas through a comparative analysis of the current management systems in each location. The results of this study can be the basis for shared decision making on steps toward more integrated and holistic use and management of natural resources from source to sea and it identified opportunities for dialogue between Chinese and European partners for knowledge exchange and joint research to address common challenges.
- **Luga River and Bay:** In the bilateral programme between Russia and Sweden it has been agreed that the joint working group for Water Resources and Marine Environment will focus on marine spatial planning, in accordance with UNESCO guidelines. It aims towards a holistic management strategy for large river systems, which may be achieved through implementation of the existing source-to-sea approach. This study was performed in order to minimize negative environmental impact on the water quality of the Baltic Sea and in the long-term to achieve the objectives of the Baltic Sea Action Plan (BSAP). In Sweden, the responsible authority for the bilateral programme is SwAM and in Russia it is the Ministry of Natural Resources and Environment of the Russian Federation (Minprirody of Russia).
- **KwaZulu-Natal:** Sweden and SwAM have since 2015 had a bilateral collaboration around the source-to-sea approach with the Republic of South Africa, specifically with the South African Department of Forestry, Fisheries and the Environment (DFFE, previously DEFF and DEA) and its Oceans and Coasts branch. The DFFE has identified marine litter and plastic as a prioritised issue for the nation in general and the KwaZulu-Natal region in particular and has prior to this study developed a Concept Note (DEA 2017) and an Action Plan (DEA 2018) for marine litter management based on the source-to-sea approach. In parallel with this study, DFFE has started rolling out activities in the KwaZulu-Natal region (eThekweni Municipality) in line with their updated national Source-to-Sea programme (DEA 2019). This screening study is meant to support DFFE and complement their ongoing work, which places a high focus on the recovery of litter (stemming from both land and riverine areas) but also on waste management practices, advocacy, education and job creation.
- **Göta River:** SwAM is responsible for marine and water management in Sweden and as such conducted this analysis of the development of water management in the catchment of the Göta River and its coastal waters from the first half of the 20th century until year 2020. The source-to-sea approach is applied to structure this analysis by identifying: 1) the activities which led to an alteration of the natural state of key flows and thereby to a deterioration of the natural systems; 2) the stakeholders involved and their roles; 3) the regulatory framework; and 4) how the combination of these factors impacted on the design and implementation of interventions to improve the environmental status of the catchment and its coastal waters. The aim of the study is to provide an example of how a management approach which applied a source-to-sea perspective before the concept as

such had been formulated helped to achieve a remarkable environmental recovery and in this way, validate the application of this approach to source-to-sea challenges.

- **Three Archipelagos:** The project focuses on the Stockholm-Åland-Turku archipelago area and contributes to SwAM's regulatory letter for 2019, condition 15, which states that the agency should strengthen regional work in the Baltic Sea. The Three Archipelago project supports the authority's commitment regarding work with the EU Baltic Sea Strategy and Sweden's national maritime strategy. The project is well connected to the goals contained in the Baltic Sea Strategy: 1) "Save the marine environment"; 2) "Link the region"; and 3) "Increase prosperity". It also links to goals in the Maritime strategy, i.e., "To support competitive, innovative and sustainable maritime industries that can contribute to increased employment, reduced environmental impact and an attractive living environment". The project aims to investigate, develop, make proposals and simply describe how cohesive ecosystems and their services can support and stimulate a healthy and sustainable socio-economic development in the affected archipelago areas.
- **Lake Hawassa Sub-basin:** Project activities were undertaken while the Rift Valley Lakes Basin Office was preparing the Strategic IWRM Plan for Ethiopian Rift Valley Lakes Basin for 2020-2035. As an 'added value', the planning team made use of 'source-to-lake' approach (S2L) (based on the source-to-sea approach to be applicable to an endorheic lake basin). Using the source-to-lake approach enabled an explicit in-depth analysis of planning components such as stakeholder assessment, governance baseline and theory of change that supported identification of appropriate solutions towards sustainable water resources management.
- **Vu Gia-Thu Bon River Basin:** A Joint Coordination Committee (JCC) was established in 2016 to solve inter-provincial, inter-regional issues and is made up of Provincial Committee Chairmen of Quang Nam Province and Da Nang City, and key agencies relevant to the management of Vu Gia - Thu Bon River basin and the Quang Nam and Da Nang coastal areas. The focal point agencies of the JCC are the two provinces Natural Resources and Environmental Departments (DONRE). Relevant departments participating in the coordination include Department of Planning and Investment, Department of Finance, Department of Agriculture and Rural Development, Department of Construction, Department of Trade and Industry, Department of Transport, Department of Health, Department of Science and Technology, Hydro-meteorological Observatory in the Mid Central region, and Hydro-meteorological Observatory in Quang Nam Province. The JCC is responsible for developing relevant detailed regulations and operational plans and implementing those plans in the coordination process. Project activities were intended as input to an action plan to reduce plastic waste pollution to the ocean to be developed under the JCC.

### 3.3 Determining readiness level for source-to-sea management

The objectives to be met through applying the source-to-sea approach span initial awareness raising of the linkages from land to freshwater, coasts and the ocean to fully developed cross-sectoral coordination in the management of source-to-sea systems and the implementation of action plans that developed with consideration of these linkages. Each regional, national and/or local context will have a different level of readiness for undertaking source-to-sea management (Figure 3). Determining this readiness level is critical to finding the correct entry point for exposure to the source-to-sea concept and application of the source-to-sea approach. Figure 3 presents different stages along the continuum of readiness levels for source-to-sea management and indicates the objectives, activities and outcomes for each readiness level. In many contexts, the readiness level may cross different stages presented here, and some stakeholders may be more or less developed in their readiness to implement source-to-sea management. In these

cases, stakeholders that are at a more advanced readiness level can be an ally in exposing remaining stakeholders to the source-to-sea approach, e.g., by leading sensitization of other stakeholders, being the host for stakeholder events or developing internal capacity so they can take leadership roles in implementing the source-to-sea approach.

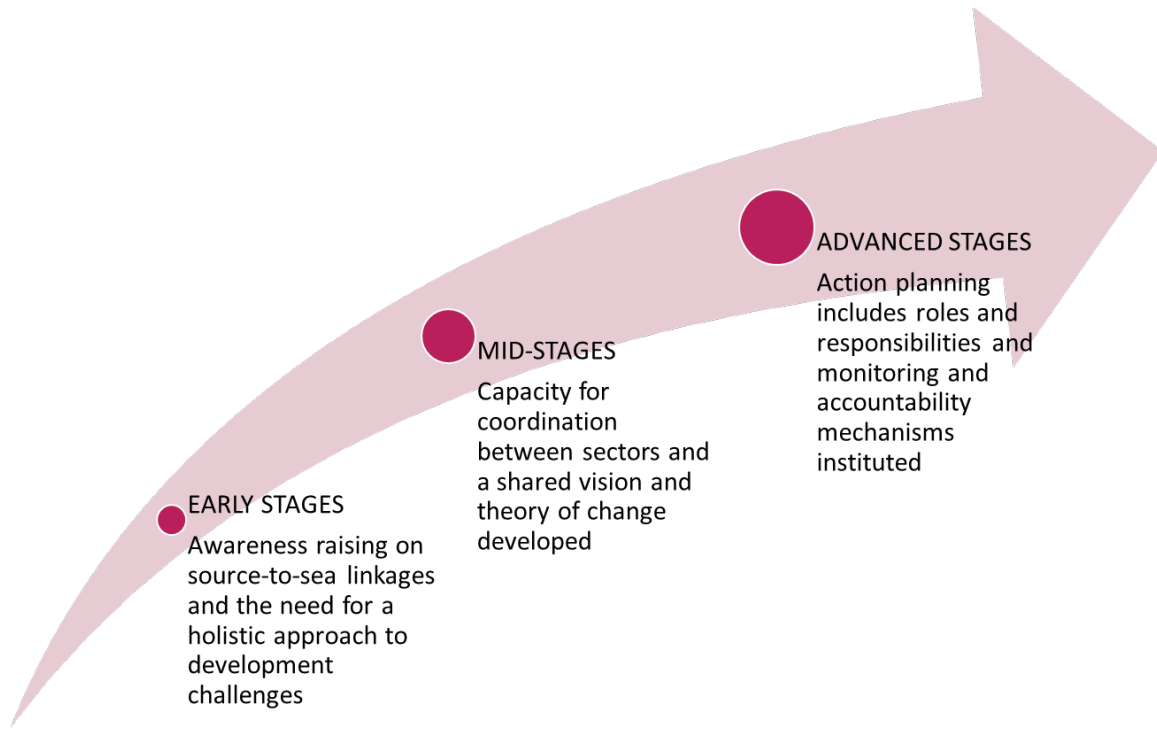


Figure 3: Stages of readiness levels for source-to-sea management.

Table 2: Identifying objectives, activities and outcomes for implementation of the source-to-sea approach based on source-to-sea management readiness levels.

	EARLY STAGE	EARLY STAGE	MID-STAGE	MID-STAGE	MID-STAGE	ADVANCED STAGE	ADVANCED STAGE	ADVANCED STAGE
<b>Current state of source-to-sea management readiness levels</b>	Little/no source-to-sea knowledge or understanding	One or more source-to-sea challenges have been identified	Progress on addressing source-to-sea challenges is hampered by lack of cross-sectoral coordination	Stakeholders need to be aligned around a shared vision of the desired future condition for the source-to-sea system	Stakeholders' demands for action on source-to-sea challenges has grown and been raised with relevant authorities	Actions to be taken to address the source-to-sea challenge(s) need to be prioritized	Agreement on an action plan is needed	Actions are being implemented and evidence of their benefits/impacts is needed
<b>Key objective</b>	Awareness is raised of the linkages from land to freshwater, coasts and the ocean	Awareness is raised of the need for a holistic approach to engaging stakeholders across the source-to-system and sectors	Capacity is developed and mechanisms established for coordinating strategies, policies, plans and practice across sectors	A shared vision for the future is agreed upon by all stakeholders	Stakeholders agree on a theory of change that expresses how the shared vision for the source-to-sea system will be reached	Stakeholders agree on the priorities for investments into enabling conditions and support for changing behaviours and practices	Secure agreement from stakeholders on the actions to be taken and roles and responsibilities to deliver them	Monitoring system that builds evidence-base of links between alterations in source-to-sea flows, environmental, social and economic impacts, and behaviours, practices and enabling conditions
<b>Source-to-sea approach steps to apply</b>	Step 1: Characterization	Step 2: Engage	Step 3: Diagnose	Step 4: Design – first stage of identifying the desired future condition	Step 4: Design – second stage of defining the theory of change	Step 5: Act – first stage of prioritizing actions	Step 5: Act – second stage of accountability for completing actions	Step 6: Adapt

<b>Preparatory activities</b>	Collect existing knowledge of source-to-sea key flows	Prepare an initial analysis of source-to-sea stakeholders	Prepare a governance baseline of institutions and instruments	Survey stakeholders on desired future condition	Collate and map Steps 1, 2 and 3 outputs to orders of outcome	Prepare a draft assessment of actions	Prepare a draft accountability framework for prioritized actions	Prepare a draft monitoring plan based on theory of change and accountability framework
<b>Engagement activities</b>	Share characterization of key flows from desk study, consult stakeholders on knowledge of key flows, facilitate selection of priority flows	Share stakeholder analysis with stakeholders, and facilitate stakeholder mapping exercise to feed into stakeholder engagement plan	Share governance baseline, facilitate governance mapping exercise, conduct training and capacity development in source-to-sea management	Facilitate the development of a shared vision for the future through an inclusive, bottom-up process	Facilitate stakeholders in developing a theory of change that can be used to identify intervention strategies	Facilitate priority-setting processes of actions based on intervention strategies developed from the theory of change	Facilitate stakeholders in developing an accountability framework for the action plan that clearly indicates roles and responsibilities for each action	Engage a monitoring working group to finalize the monitoring plan, establish monitoring and reporting protocols and mechanisms and secure commitments of long-term investment in monitoring
<b>Projected outcome</b>	Deeper understanding of the linkages between land, freshwater, coasts and the ocean from environmental, social and economic perspectives	Clarification of stakeholders to be engaged in further steps in source-to-sea processes and an engagement plan	Key institutions adopt source-to-sea perspectives and cross-sectoral dialogue is strengthened	A high-level goal representative of source-to-sea stakeholder interests	Assumptions on the linkages between desired future condition, changes in behaviours and practices and enabling conditions are explicitly documented	Draft plan with prioritized actions based on assessment of impact, feasibility and relevance achieving desired future	Shared understanding of individual and collective responsibilities for implementing the action plan	Long-term monitoring that can feedback on theory of change and support progressive adaptive management

An analysis of stakeholder readiness levels in each of the studies and pilots is useful in understanding the specific application of the source-to-sea approach and provides an indication of potential next steps to be undertaken to reach a full implementation of source-to-sea management in each of the locations.

- **Bohai-Baltic Seas:** China has recognized that progress toward reducing the negative impacts of economic development and population pressures is hampered by lack of coordination between jurisdictions. It has instituted a River Chief System and Bay Chief System as one type of mechanism to address this. With the main tasks of water resources protection, pollution control and environmental improvement and ecological restoration, the River Chief System will be implemented at the provincial, municipal, county and township levels. The Bay Chief System is based on the main functional planning zones. Its goal is to fulfil the responsibility of local governments to improve the quality of marine environment and maintain marine ecological security. These systems are in their early stages of implementation and establishment of coordination mechanisms. Coordination between the River Chief System and the Bay Chief System is yet to be developed. The recognition of the need for greater levels of coordination between segments of the source-to-sea system that have been instituted through the River and Bay Chiefs Systems puts China at the beginning of the mid-stage readiness level. This indicates that next steps can focus on capacity development in coordination across jurisdictional boundaries and awareness raising in the need for and benefits of holistic source-to-sea management.

Through HELCOM the Baltic Sea region has agreement on a Baltic Sea Action Plan. Based on this, the Baltic Sea region is in the advanced stage of the source-to-sea readiness level. Focus here needs to be on implementation of the prioritized actions. There is significant disparity in the capacity to implement the Baltic Sea Action Plan between the 14 countries in the Baltic Sea basin. Readiness levels for implementing source-to-sea management needs to be assessed at the national and sub-national levels. Based on this analysis, context-relevant support can be developed. Knowledge sharing and learning exchanges between countries can help the condition of the Baltic Sea improve more rapidly. Due to the institutional and jurisdictional complexity of the Baltic Sea region, activities to promote the uptake of the source-to-sea approach need to happen at sub-national to basin-wide levels simultaneously and in a heterogeneous way that reflects spatial differences in source-to-sea readiness.

- **Luga River and Bay:** Stakeholder workshops were held with local stakeholders in Luga Town, a small town in the Luga River basin, and in St Petersburg, the provincial capital, with national level stakeholders. The stakeholders identified a range of issues that slowed progress toward reduction of nutrient pollution and recovery of salmon populations, e.g., poor enforcement of regulations, old technology and limited resources for monitoring, lack of environmental education and awareness of the public and lack of coordination between sectors and stakeholders. The level of readiness varied between stakeholders, resulting in different perceptions of the issues and a lack of a shared knowledge base for those perspectives. Engagement between provincial and local levels has been limited. This indicates that overall, the Luga River and Bay stakeholders are in the early stages of readiness level even though there is evidence of the recognition that more coordination



across governance bodies and functions and support at both local and provincial levels that taking action is needed.

Next steps in the Luga River and Bay would be to create more continuity in the awareness and understanding of the issues across all stakeholders by developing a shared knowledge base. Given the importance of changes in behaviour and practices at the local level, provincial level actors need to create more opportunities for knowledge sharing between local and provincial stakeholders, ensuring that stakeholders from different segments of the Luga River and Bay system participate. Developing a shared view of the source-to-sea challenges across all stakeholders can support the development of a cohesive group of actors working toward the same goal. At the provincial level, bringing together public, private and civil society actors will lay the groundwork for developing a shared vision, theory of change and action plan. While plans do already exist, their implementation is limited; stepping back and strengthening relationships between stakeholders, creating a common knowledge base and working toward better coordination between actors could improve implementation levels.

- **KwaZulu-Natal:** The source-to-sea concept has been introduced through the cooperation between SwAM and primarily DFFE in South Africa, which has been ongoing since 2015. This created a willingness within DFFE to undertake this study and to use it as a pilot that could later be replicated elsewhere in South Africa. While recognition of the benefits of the source-to-sea approach is high within DFFE, there is less acceptance at the local levels. To prevent plastic waste pollution in waterways and the coasts there is a critical need to change the behaviour of all stakeholders who contribute to plastics production, its use and the (mis)-management of plastic waste. Awareness raising campaigns on their own cannot bring about the much-needed change in behaviours that will reduce plastics pollution to water resources. More creative and engaging capacity development programmes together with creating an enabling environment are vital to elicit the necessary changes in behaviour. To stimulate interest in the source-to-sea approach as a means for achieving these aims, SwAM and DFFE have agreed to continue their collaboration and in partnership conduct cost-of-inaction studies. The aim of the studies is to identify and assess socio-economic costs that comes from the impacts of plastic pollution in the eThekweni municipality in order to get a well-informed, more committed and accountable leadership in terms of solid waste management. This is an example of a national institution with a more advanced source-to-sea readiness level taking steps to raise the readiness level of local actors, who are essential to addressing the source-to-sea challenge of plastic pollution.
- **Göta River:** By evaluating the period from the end of the 19<sup>th</sup> century to the present, three phases of evolution in source-to-sea management readiness levels are explored: 1) a phase of industrialization and urbanization, with only minor environmental control; 2) a state of severe environmental pollution; and 3) subsequent recovery based on intensive development in environmental research, governance and management consolidation, and expansion and internationalization of environmental management. Intolerable impacts on human health and the environment due to years of pollution produced the initial readiness for using the source-to-sea approach. From the mid- to late-20<sup>th</sup> century there was fast-paced development of environmental research which provided the basis for understanding the linkages between human activities and their impacts. The scientific

community became a very important enabler during this phase. By proving the connections between pollution and environmental degradation, most prominently for mercury but also for eutrophication, research drew the public's attention to the damaging effects of pollution and helped to lift environmental protection far up the national and local political agendas.

This historical analysis for the Göta River clearly demonstrates the evolution from lack of awareness of source-to-sea linkages and of the impacts of human activities on the source-to-sea system to formalized institutions for multi-stakeholder engagement and shared responsibility for managing the source-to-sea system. It shows how this can build up from municipal levels to transboundary, international agreements and commitments. It also presents the continuous improvement of legislation and other governance modalities that incrementally restructure the balance between economic, environmental and social values and, over time, provide more protection for the environment. Taken all together, these governance changes represent higher levels of commitment to source-to-sea management of the Göta River.

- **Three Archipelagos:** The assessment of the impacts of boating on the three archipelagos largely reflected on the level of readiness for a fully circular approach to the manufacturing to end-of-life disposal of boats across different stakeholders and within the governance system. It assessed the use of toxic or biocide materials and the readiness for eliminating their use entirely. Individual boaters' behaviours related to dumping of toilet and other forms of waste were also considered. It looked at a range of actors that can influence these two aims, e.g., manufacturers, retailers, boat clubs and marinas, and consumers as well as the EU, national and municipal governments, indicating a need to work synergistically across these stakeholders.

While some regulations are in place at different levels that can support the move toward reduced use of toxic or biocide chemicals, increased recycling of boats at the end-of-life and controlled management of waste during boat use, there are significant gaps in legislation and enforcement. There is limited capacity at the national level to influence resource extraction and production of boats; this is more effective at the EU level. Demand from consumers for recyclability of boats is low, hampering the investments needed to design and produce these boats. Transformation to a circular economy for boats needs to be approached holistically across the different actors from resource extraction to resource recovery and must span awareness raising to new technologies and services. A comprehensive view of existing legislation and its gaps is needed to identify what governance is needed from the EU to the municipal levels. Similarly, evaluating the services required to enable recycling of boats is needed. To increase demand, raising awareness of the benefits of recyclable boats and limiting toxic and biocide chemicals amongst existing and new boat owners will help stimulate more production of alternatives. The study showed that boat users' willingness to recycle increased with ease of access to recycling services.

Low levels of awareness of the range of impacts that boats can have on the environment during their use and maintenance were indicated. Municipalities have a large share of responsibility for regulating boat use but do not have all the tools in place to do so. Marinas and boat clubs have a more direct relationship with boat users and can play an

important role in providing services and raising awareness that will reduce boaters' impacts on the marine and coastal environments. Changing behaviours requires both improved understanding of impacts and how to reduce these while using boats. It was noted that there is a strong, traditional culture related to boating: changing this culture to adapt to modern conditions and concerns is necessary to achieve more sustainable boat manufacturing and use. While increased enforcement of existing regulations can help, this cultural shift will have a stronger, lasting impact. Ultimately, there needs to be a comprehensive multi-level approach from awareness raising to governance that fills the current gaps and strengthens those areas that are too weak to result in the desired changes.

This is also true when considering the different human behaviours that have a negative physical impact on the coastal habitat. A holistic perspective and a consensus through all levels of government to effectively address the issues of fisheries management and licensing, recreational, small-scale and commercial fishing and processing, and habitat protection. Despite a great responsibility for environmental supervision, the municipalities do not have an overall mandate or policy instruments to influence or manage the conditions of coastal fishing. Existing fisheries legislation originates largely from the EU and often lacks a local management perspective. Commercial fishing is regulated in detail, while recreational fishing is in principle unregulated.

- **Lake Hawassa Sub-basin:** Lake Hawassa sub-basin stakeholders had a high level of awareness that they had a source-to-lake (adapted from source-to-sea) challenge due to the very evident link between land use practices in upland areas and sediment infill of the lake. Stakeholders were quick to engage in the source-to-sea approach and welcomed this way of looking at their local challenges. This perspective was also easily applied to the issue of plastic waste leakage to the lake. Participation in the source-to-sea approach was tied to the development of the Strategic IWRM Ethiopian Rift Valley Lakes Basin Plan 2020-2035, which is aimed at integrating activities across the basin. Analysis of the governance system highlighted the cross-sectoral nature of the challenges with different ministries and their regional counterparts being responsible for different activities and sub-segments of the source-to-lake system. This was also true at the city administration level with departments being responsible for sub-sections of waste collection and management. The division of responsibility has led to poor levels of solid waste management services. The clear understanding of the source-to-lake nature of issues affecting Lake Hawassa did not yet translate to the willingness to break down management silos and coordinate across institutions to reach better outcomes for the lake. Building better relations between the responsible parties and stronger coordination across government institutions is needed to move toward source-to-sea management of the Lake Hawassa sub-basin.
- **Vu Gia-Thu Bon River Basin:** The source-to-sea concept was first introduced in the Vu Gia-Thu Bon River basin through bilateral cooperation and technical exchanges between Sweden and Vietnam. The focus of that engagement was the hydropower development happening in the upper parts of the basin. In this project, the focus was plastic waste leakage to the environment and the source-to-sea approach was useful in illuminating the disparity in waste collection and management across the basin, most particularly between

urban and rural communities. A technical training in applying the source-to-sea approach to plastic leakage and other source-to-sea challenges at the basin level was conducted for staff from the provincial Departments of Natural Resources and Environment (DONRE) who are responsible for solid waste management in urban areas. However, the Department of Agriculture and Rural Development (DARD) has this responsibility in rural areas. The Interprovincial Joint Coordination Committee is one mechanism that supports improved coordination between provinces, and potentially between governmental institutions. However, coordination that results in source-to-sea management of solid waste is yet to be realized.

### **3.4 Implementing the source-to-sea approach: Steps 1-4**

The five studies commissioned by SwAM included Steps 1-4 of the source-to-sea approach; the two pilots conducted by SIWI included Steps 1-3. *Implementing the source-to-sea approach: A guide for practitioners* provides general guidance on the six steps of the source-to-sea approach. Each application implements these steps in slightly different ways, in some cases combining previously existing methods with those developed in the source-to-sea approach. This intersection of existing methods and the source-to-sea approach enriches its applicability and the outcomes of applying the six steps of the approach. The adaptation of the source-to-sea approach to the specific application and its combination with other methods is part of its natural evolution.

Step 1: Characterize – Selecting priority flows and determining the system boundary

#### ***Selecting priority flows***

Several of the studies completed an overview of all six source-to-sea key flows before selecting the priority flows to focus in on for the complete analysis. This quick desk study of all key flows assessed the overall condition of the source-to-sea systems. Given the synergistic nature of the key flows, the overall condition of the source-to-sea system may be important to consider when making recommendations on steps to be taken to address alterations to the selected priority flows. In the Bohai-Baltic Seas study, the selection of priority flows was based on three criteria:

1. if the impacts of the alteration are a major environmental challenge;
2. if the alteration is present in both studied seas; and
3. if the flows highlight different aspects of the source-to-systems.

In the Luga River, the choice of priority flows was based on four criteria:

1. if the impacts by the alteration constitute major environmental challenges with economic and social relevance to the local communities;
2. if the key flow highlights different segments of the source-to-sea system;
3. if the key flow in a broad way reflects both local, national and potentially even global interests; and
4. if the alteration is targeted by the Baltic Sea Action Plan and also relevant for the bi-lateral cooperation between Russia and Sweden.

All key flows have been altered in the Göta River; the priority flows for this study were selected based on the following criteria:

1. if they are strongly connected to the industrial and urban development of the source-to-sea system;
2. if effective or promising intervention strategies have been developed and applied to improve them, based on a successful combination of research, stakeholder involvement and governance interventions, a management approach with many similarities to a source-to-sea concept; and
3. if they continue to be of relevance to the source-to-sea system's environmental status today.

In the Three Archipelagos study area, a desktop survey of existing information quickly reviewed the alterations to the key flows. The survey indicated alterations to all key flows with pollution, materials, biota and ecosystem services having been altered extensively. From this, the priority flows selected to study further in this report were materials and biota. The focus is on how boating affects the local environment and for biota what changes there are in coastal fish communities and stocks. These two priority flows are not necessarily the biggest problems in the Baltic Sea, but were determined in consultation with the Swedish Maritime Administration. They were selected because they both are of particular importance to this unique archipelago environment and raise questions of interest for the Administration to study more deeply.

### ***Determining assessment scope and approach***

These studies provide examples of how to narrow down the focus of a source-to-sea analysis, which can be an important step to not getting bogged down in characterization of the key flows. This prioritization helps maintain momentum in progressing through the six steps. The studies also showed useful variations and considerations for determining the scope and approach of the characterization assessment.

In the case of KwaZulu-Natal province, for example, the project team had previous experience in the location that allowed them to quickly compile existing data and analysis. The type and amounts of plastic waste are presented with clearly identified sources as well as a well elaborated discussion on the impacts of plastic leakage to the environment. GIS mapping was used to present hotspots of plastic leakage and an analysis of the types of interventions that could be applied in specific locations was made. This is a good example of how existing analyses can be built upon when applying the source-to-sea approach.

The Three Archipelagos study combined the source-to-sea approach with life cycle analysis to assess the impacts of boats and their use. Their assessment looked across the full life cycle of boats from raw materials to end-of-life disposal or resource recovery and including energy use. The life cycle analysis perspective was applied to the life histories of fish from reproduction to end of life through fishing and processing. Applying life cycle analysis to the characterization in Step 1 of the source-to-sea approach created a structure for identifying impacts throughout the life cycle of boats.

In the Lake Hawassa sub-basin, consultation with local stakeholders identified sediment erosion and plastic waste as priority issues. There were existing task forces formed under the GIZ IWaSP programme that were actively involved in discussions on how to address these two issues. In the

Vu Gia-Thu Bon River basin, plastic waste and its role in marine litter had been prioritized at the national, provincial and municipal levels. The two provinces within the Vu Gia-Thu Bon River basin have formed an Interprovincial Joint Coordination Committee to address issues of shared concern. The Committee had identified plastic waste and marine litter as an issue to work together on and included plastic waste in its work plan. With these priorities already identified in both locations, an assessment across all key flows and selection criteria for the priority flows was not necessary. This enabled time and resources to be spent on a source-to-sea characterization of these priority flows.

In both pilots, new studies were commissioned to characterize the priority flows – sediment and plastic waste in the Lake Hawassa sub-basin and plastic waste in the Vu Gia-Thu Bon River basin. International experts were engaged to illustrate and quantify the breadth of the issues and provide internationally accepted methodologies for analysis. Local experts were drawn upon to gather additional detail through field studies and interviews. This body of knowledge was further complemented by local knowledge collected during the workshops held in Hawassa and Hoi An. These studies were formulated to account for source-to-sea linkages and contributed new knowledge to the stakeholder engagement process. For example, in the Vu Gia-Thu Bon River basin, the characterization of plastic waste management across the basin illuminated the disparity in waste collection services between urban, rural and coastal areas and how this impacts plastic leakage amounts from these areas. Without this new study, the need to address solid waste management from source-to-sea would not have been so clearly evident since most studies focus on one location and do not take this holistic view of the source-to-sea system.

### ***Choosing the system boundary***

Given the size and diversity of the Bohai and Baltic Seas' basins, the system boundary for the analysis in this study was selected to be the Hai He River basin in China and the Northern Baltic Sea Water District in Sweden. The sub-basins were selected because they were relatively small, compared to the total catchments, and at the same time have large populations and economic activity that link them clearly to the priority flows. In the Luga River, the system boundary was based on the alterations to the priority flows, their sources and impacts. For the priority flow *wild salmon*, the middle and lower sections of the river basin were selected and for the priority flow *nutrients*, the full river basin was chosen. The lower reaches of the uMngeni catchment below the Inanda Dam within the eThekweni municipality were selected as the system boundary for the KwaZulu-Natal study. This area was chosen because the eThekweni municipality is the third largest population centre in South Africa and the Inanda Dam blocks plastic coming from upstream. This allowed the analysis to focus on plastic waste leakage originating within the study area. The Göta River, Lake Hawassa sub-basin and Vu Gia-Thu Bon River basin cases chose the entire basin as the system boundary. The Three Archipelagos study defined a system boundary that included all three archipelagos and their surrounding waters but this is not a previously defined geographic area and has somewhat artificial boundaries since it is quite difficult to separate this area from the larger Baltic Sea.

Step 2: Engage - Mapping primary, targeted, enabling, supporting and external stakeholders and preparing an engagement plan

The source-to-sea approach uses five categories for stakeholder assessment; these give a clear structure for mapping stakeholders to their potential roles in the specified source-to-sea challenge. The source-to-sea stakeholder categories are:

**PRIMARY STAKEHOLDERS** | Primary stakeholders are affected by the alteration of priority flows and benefit from the intervention strategies.

**TARGETED STAKEHOLDERS** | Targeted stakeholders are actors or sectors whose practices are contributing to the alteration of priority flows and whose behaviour intervention strategies are aimed at changing.

**ENABLING STAKEHOLDERS** | Enabling stakeholders provide the enabling conditions for behaviour changes to occur and benefits to be sustained over time.

**SUPPORTING STAKEHOLDERS** | Supporting stakeholders include development partners or financiers whose strategies are aligned with and can support the source-to-sea objectives.

**EXTERNAL STAKEHOLDERS** | External stakeholders are individuals or groups outside of the system boundary who share an interest in the outcomes of the project or programme.

### ***Stakeholder assessment***

The Bohai-Baltic Seas and Three Archipelagos cases presented stakeholders for each of the priority flows. The Luga River case included a brief statement of the stakeholder's mandate or impact related to the priority flows. The KwaZulu-Natal case provided the most comprehensive stakeholder analysis of the five studies, which included an assessment of stakeholders, their mandates, incentives for participation and the proposed engagement approach, power mapping between stakeholders and diagramming spheres of influence of each stakeholder. These could be combined to feed into a comprehensive engagement plan.

The Göta River study traces the engagement of stakeholders over time and at different levels. This shows how stakeholders and their interests, and governance bodies and their roles and responsibilities, evolve over time. The scientific community is recognized as an important enabler of changes by providing an evidence-base for the linkages between human activities and their impacts.

In the Lake Hawassa sub-basin and Vu Gia - Thu Bon River basin, the stakeholder mapping included identifying the level that each stakeholder primarily engaged at (local, basin, national, global), the source-to-sea segment they were most closely related to (land, freshwater, coastal, marine) and the sub-segment (rural, urban). This analysis anchors the stakeholders geographically within the source-to-sea system. It also evaluated the stakeholders' interest in taking action to improve the condition of the source-to-sea system and their ability to influence this, either positively (strong) or negatively (weak).

## **Gender analysis**

Gender analysis was included in four of the five studies and the two pilots, to some extent. The level of analysis was limited, in large part due to the lack of sex disaggregated data. However, cultural perspectives on gender stand out as a dominating factor in relation to the levels of participation of each gender in specific activities as well as in decision making processes. In the Luga River, a questionnaire on gender was filled in by workshop participants that exposed limited awareness of the gender aspects of water management and the power relations between men and women in decision-making settings. Traditional roles for women and men in the Zulu culture stood out as an important context for designing engagement activities and determining future interventions in South Africa. Information on gendered aspects within the Göta River source-to-sea management system and within Swedish water management at large was not found. On a local and national level, gender has not been considered in water management so far in ways that reflect its actual importance. The EU Water Framework Directive is also not gender sensitive and does not focus on gender awareness nor the importance of gender equality and inclusion of gender analyses in water management.

Gender differences were noted in the two pilots. For example, in the Lake Hawassa sub-basin the majority of participants in workshops and trainings were male, while in the Vu Gia-Thu Bon there was much more balanced gender representation. In the informal resource recovery sector in Lake Hawassa sub-basin, the business aspects of plastic bottle collection are managed and performed by men and the recycling station is owned by a man. The processing of plastic bottles for shipment was done by women. In the Vu Gia-Thu Bon River basin, the collection and processing of recyclable plastic was also handled by women. Understanding these gender roles and relations is a critical, and underexamined, context to be addressed in stakeholder engagement activities.

### Step 3: Diagnose - Analysing the governance system and practices for priority flows

The purpose of the governance analysis is to understand the existing governance instruments and institutions related to the source-to-sea challenge and the geography of the source-to-sea system. This analysis can include identifying the strengths and weaknesses of governance instruments, where there are gaps and overlaps and the levels of and barriers to their implementation. This analysis can then be used to determine how the enabling conditions need to be adapted, improved, strengthened or added to so they support the desired changes in behaviour and practices.

In Figure 4 governance instruments and institutions relevant to the study area in the KwaZulu-Natal province are mapped along the source-to-sea continuum, showing the complexity of the governance system. This spatial analysis was complemented with a hierarchical analysis as well as an assessment of the gaps and overlaps among different stakeholder groups. This facilitated the identification of where lack of coordination and communication were hampering effective governance and action. A further layer of assessing political and relationship dimensions was discussed, highlighting the limitations of a governance baseline that only looks at what exists without analysing the constraints that may limit realizing the full potential of the instruments and institutional mandates.



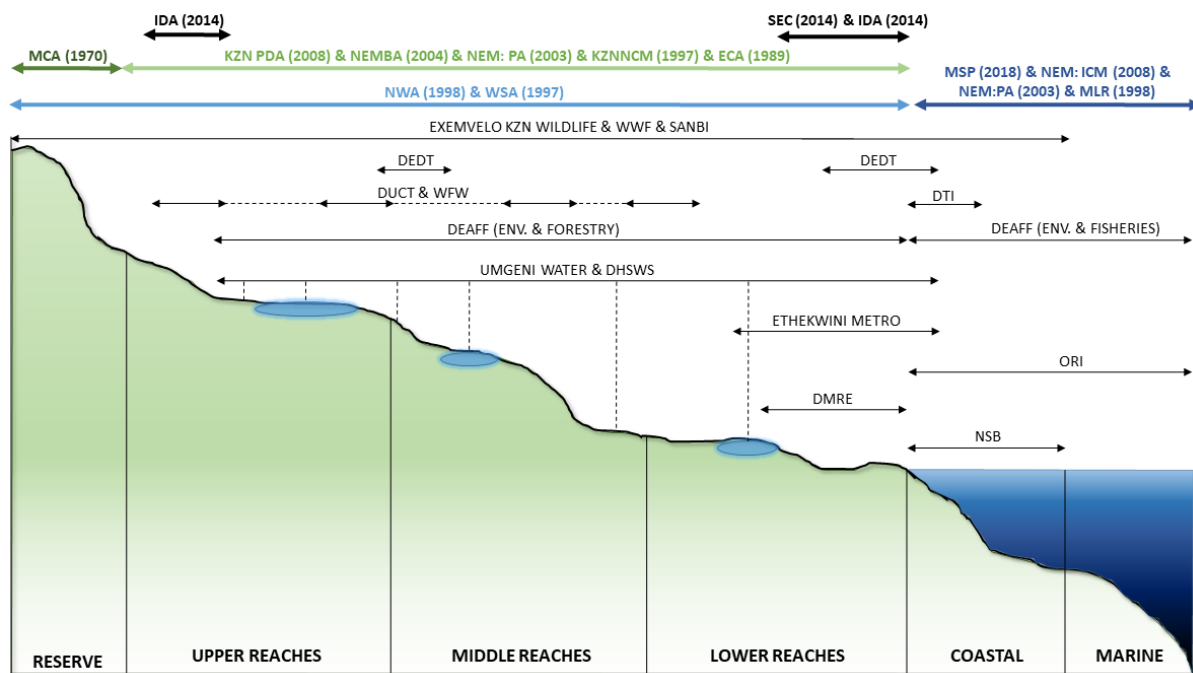


Figure 4: Schematic of the governance instruments and institutions along the source-to-sea continuum Source: Havs-och-vattenmyndigheten, 2019

This challenge of assessing the effectiveness of the governance baseline was also taken up by the Lake Hawassa sub-basin and Vu Gia-Thu Bon River basin pilots. All governance instruments were identified by the instrument type (policy, strategy, law, regulation, plan, procedure, agreement), the governance level (global, national, state, basin, municipal, local) and the source-to-sea segment (land, freshwater, coast, ocean). The relevance of the instrument (high, medium, low) to addressing the source-to-sea challenge as well as its strengths and weaknesses were assessed. For institutions, the mandate, key related instruments, institution type (government, multi-stakeholder, ad hoc) and relevant source-to-sea segment were all defined. Additionally, the effectiveness of the institution in fulfilling its mandate and the key barriers to implementation were indicated.

The Bohai-Baltic Seas study provided an analysis of the administrative linkages between different source-to-sea segments and authorities. The Luga River study presented a multi-level view of the governance from national to inter-regional, regional and local levels. The Three Archipelagos study provided a description of governance related to the priority flows, highlighting where the gaps in legislation, etc. exist. A historical analysis of the governance instruments and institutions was presented in the Göta River study. Each of these provide a baseline of information that can be the basis for further inspection of the enabling conditions.

#### Step 4: Design - Developing a theory of change and determining intervention strategies

The theory of change lays out the conditions for success. It is built upon the first three steps that collate knowledge of the biophysical system (Step 1: Characterize), the social system (Step 2: Engage) and the governance system (Step 3: Diagnose) (Figure 5).

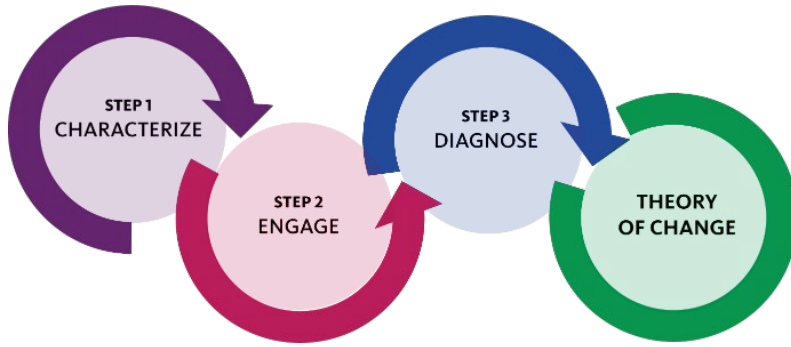


Figure 5: Information gathered in Steps 1, 2 and 3 is used to develop the theory of change. Source: Mathews et al., (2019)

The source-to-sea approach utilizes four orders of outcome to structure the theory of change. Establishing the necessary enabling conditions (1<sup>st</sup> order outcomes) is the first step in the theory of change. This supports the changes in behaviour (2<sup>nd</sup> order outcomes) needed to bring about the changes in the state (3<sup>rd</sup> order outcomes) of the source-to-sea system and ultimately the desired long-term impacts (4<sup>th</sup> order outcomes) (Figure 6).

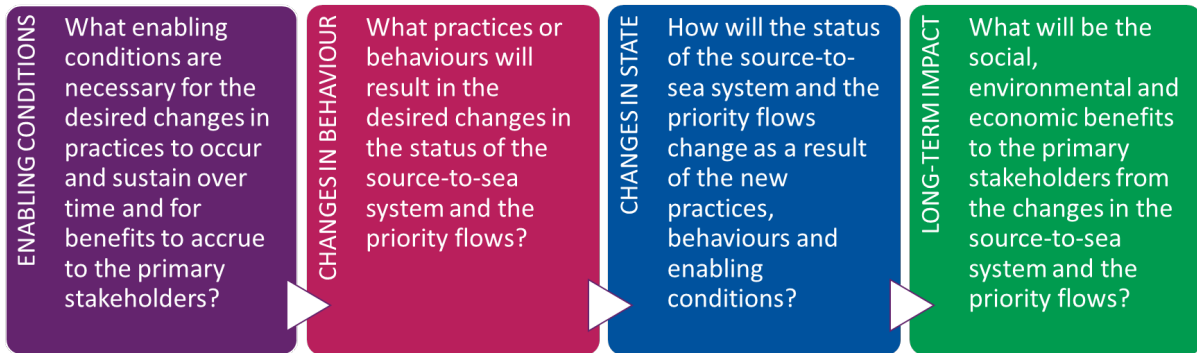


Figure 6: The framework of four orders of outcome that form the basis for the theory of change

The stakeholder categories used in Step 2 can also be mapped to these four orders (Figure 7) with the primary stakeholders being the recipients of benefits from the changes in state and long-term impacts, i.e., the 3<sup>rd</sup> and 4<sup>th</sup> order outcomes. The targeted stakeholders are those whose changes in behaviour will bring about the 3<sup>rd</sup> and 4<sup>th</sup> order outcomes, therefore they are directly linked to the 2<sup>nd</sup> order outcomes. Finally, the enabling stakeholders are responsible for the 1<sup>st</sup> order outcomes, along with the supporting and external stakeholders who can help bring about the required enabling conditions. These relationships between the stakeholder categories and the orders of outcome in the theory of change were first understood and clarified in the Bohai-Baltic Seas study.

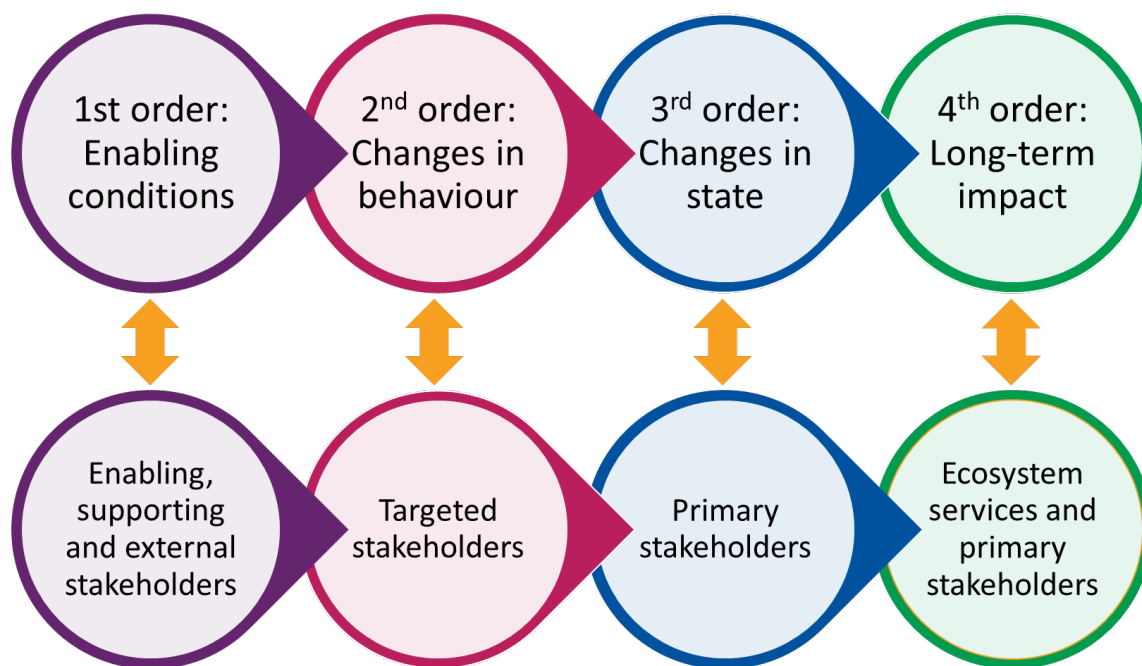


Figure 7: Relationship between the four orders of outcome and the source-to-sea stakeholder categories.

The Bohai-Baltic Seas study developed a theory of change for each of the priority flows, in each basin. For the priority flow of nitrogen and phosphorus pollution, the changes in behaviour, changes in state and long-term impacts were quite similar between the Hai He basin and the Northern Baltic Sea Water District, however, the enabling conditions were unique to the specific locations. Figure 8 presents a generic view of the theory of change for this priority flow.

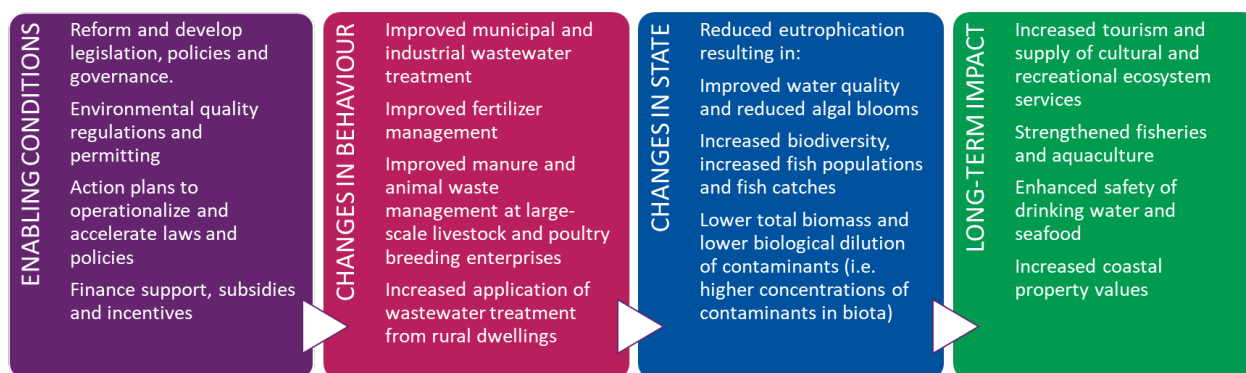


Figure 8: Theory of change for nitrogen and phosphorus pollution from land-based sources in the Hai He Basin

In its theory of change (Figure 9), the KwaZulu-Natal study identified first order outcomes (enabling conditions) of:

- well informed and harmonized leadership in policy and practice;
- higher commitment, accountability and active engagement in solid waste management from source-to-sea;
- improved knowledge and capacities in sustainable watershed management; and
- aligned incentives for responsible consumption and production.

The targeted changes in behaviour, 2<sup>nd</sup> order outcomes, to prevent plastic pollution are:

- improved coordination and collaborations in policy and practice among stakeholders;
- greater engagement in progressive power mapping and decision-making processes;
- evaluation of issues and weaknesses through deliberative processes; and
- higher awareness and capacities toward sustainable solutions.

Together these changes can bring about improved governance (transparency, accountability, and participation), reduced environmental stress and better social and economic conditions. The ultimate long-term impact (the 4<sup>th</sup> order outcome) will be a sustainable water environment and improved well-being for citizens living in the lower reaches of the uMngeni River.

Groupings of intervention strategies to bring about these changes were identified. These were further elaborated by identifying relevant stakeholders to be involved in specific interventions, as well as details on tools and methods for implementing suggested actions. The intervention strategies were grouped under broad types of actions, such as: coordination platforms, innovative communications platforms, trainings, workshops, awareness building and education, public participation meetings, market based and non-market-based incentives for solid waste management, and adoption of green technologies and innovations.

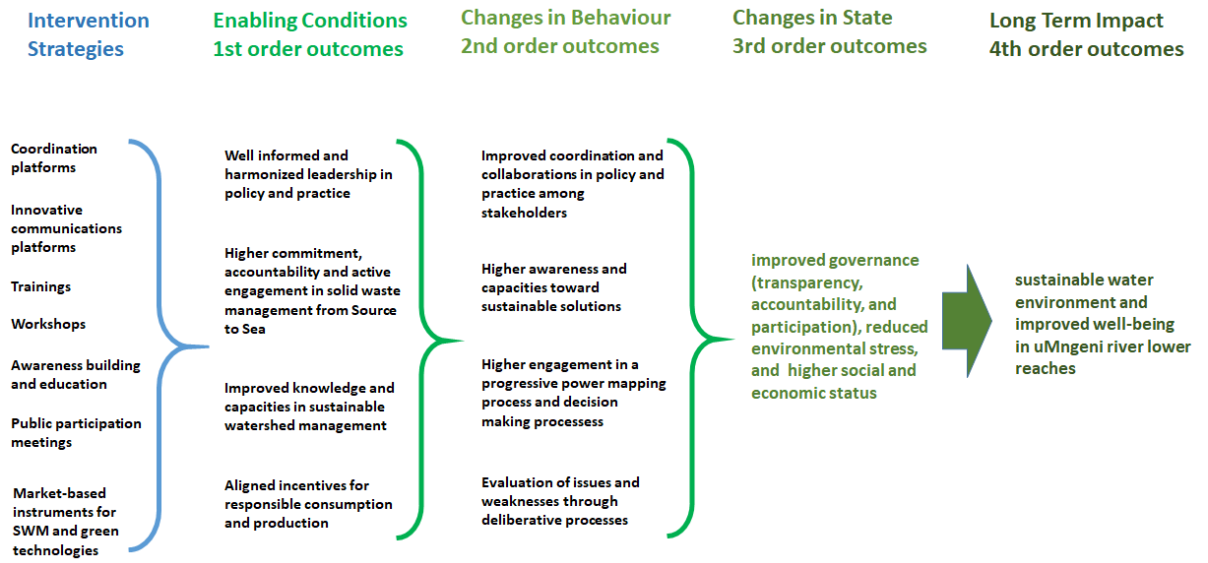


Figure 9: Theory of change showing the 1st to 4th order outcomes and intervention strategies for addressing plastic waste leakage in eThekweni

## 4. Opportunities and challenges for source-to-sea management

The purpose of the source-to-sea approach is to support the movement toward source-to-sea management, i.e., management that considers the linkages across the source-to-sea system, engages upstream and downstream stakeholders and establishes coordination across sectors.

Below is a brief discussion of the opportunities and challenges in implementing source-to-sea management.

## 4.1 Opportunities

Applying a source-to-sea perspective in addressing the world's growing development challenges increases the opportunity for truly sustainable change. Source-to-sea management builds upon existing management frameworks but broadens their scope beyond traditional, independent management of land, river basins, coasts and the ocean. It acknowledges their interconnections and breaks through silos to work across sectors and administrative boundaries. Reaching across these silos to build concerted action is urgently needed as many development challenges are source-to-sea in nature.

### 4.1.1 Addressing source-to-sea challenges

The need for source-to-sea management emerges in locations facing one or more source-to-sea challenges. Source-to-sea challenges arise when key source-to-sea flows are altered. These key flows connect land, freshwater, coastal, and marine ecosystems and activities that alter them in one location can have impacts upstream or downstream of these activities. Awareness of a source-to-sea challenge can surface when those who are being impacted by alterations in a key flow look for the origins of those impacts. This might be local community members, e.g., fishers, or businesses, e.g., tourism companies, who are reliant on ecosystem services. Or a source-to-sea challenge may come to the attention of those who are mandated with managing the key flow or the activities that are altering it. In some cases, the nature of a source-to-sea challenge may be brought forward through technical or advisory services from development partners or through advocacy and other NGOs or civil society organizations.

Understanding how key flows have been altered is a starting point for determining if a source-to-sea challenge is being faced and if source-to-sea management is needed. Some examples of alterations for each key flow are presented here. This is not an exhaustive list and general in nature.

#### *Water*

Changes in land use, water withdrawals from rivers lakes and aquifers for agriculture, industry, and household uses and growing water demands due to population growth and lifestyle changes, coupled with climate change, can contribute to decreased water availability as well as increased flood risk or flood severity downstream. As competition for limited resources grow, water scarcity has also been shown to travel downstream as resources are utilized upstream. Changes in the water cycle through human activities can exacerbate water quality issues. While dam and reservoir construction are important measures to manage water flows, mitigate water scarcity, and produce low-carbon electricity, the flows of some rivers are so highly diverted by dams and weirs that little water reaches the sea, robbing coastal ecosystems of the water, sediment, and nutrients they need. Excessive groundwater abstraction can result in saltwater intrusion to coastal aquifers.

### *Sediment*

Almost a third of global sediment flows are trapped in dams and reservoirs upstream and without the required flow of sediments from rivers, deltas and coastlines face greater risk of erosion, particularly in the face of sea-level rise. In addition, increased sediment loads as a result of activities that cause soil degradation and increased erosion risk in the catchment increases turbidity in water bodies, which can reduce primary production and alter aquatic biota populations. When sediment reaches coastal areas, it may smother organisms such as oyster and coral reefs and seagrass beds.

### *Biota*

Populations of riverine, riparian, estuarine and marine organisms can be altered either directly through overharvesting or indirectly through habitat alterations such as changes in water flows, water chemistry and geomorphology. Ecosystem connectivity, both longitudinal (e.g., upstream-downstream) and lateral (floodplain-main channel) is crucial to biodiversity and for maintaining healthy stocks of species that move between different habitats as part of their life cycle. Habitat degradation and loss and blockages of migratory pathways can severely affect these organisms.

### *Pollutants*

Wastewater treatment, agricultural runoff and plastic waste pose challenges in most regions and the resulting pollution limits the resilience of freshwater, coastal, and marine ecosystems and their ability to perform valuable ecosystem services. Excessive nutrients cause eutrophication, which can alter biota populations and may impact drinking water supplies. POPs, heavy metals and pharmaceuticals have been linked to reproductive, developmental, behavioural, neurological, endocrine and immunological adverse health effects in both humans and wildlife. Plastic and other solid waste entering waterbodies has seen a rapid increase, affecting environments along the entire source-to-sea continuum.

### *Materials*

Construction of infrastructure and other development activities modify river channels and coastlines through, for example, dredging, clearing rocks and land reclamation. This can have major implications for water and sediment flows through disconnecting floodplains, reducing aquifer recharge, altering salinity regimes and increasing erosion. Wildlife and plant populations may decrease or disappear entirely due to habitat destruction.

### *Ecosystem services*

Alterations in one or more of the key flows may result in a reduction of ecosystem services. The degradation of freshwater, terrestrial and marine environments directly impact crucial ecosystem services that provide livelihoods and food security, contribute to the water cycle and water quality and provide resilience to droughts, floods and climate changes.

Opportunities to address these source-to-sea challenges may also present themselves through an array of processes that call for upstream-downstream cooperation and/or cross-sectoral coordination. These processes may be activity based, e.g., processes developing strategies, policies, laws, regulations, plans, procedures or operations. Or they can be geographically based, e.g., transboundary cooperation in river basins or large marine ecosystems, regional or provincial

processes, catchment management, marine spatial planning and coastal zone or marine protected area management.

#### 4.1.2 Demonstrating value through pilots or screening studies

Piloting some form of the source-to-sea approach in a specific source-to-sea system can enable a broader application at the regional or national level. This was shown across the studies and projects.

For example, the pilot study in the Luga River and Bay was seen as having two key purposes. First, it demonstrated the gaps in source-to-sea management that exist in Russia and impact its implementation of the Baltic Sea Action Plan targets. Second, it showed value in identifying and engaging stakeholders in the implementation and design of actions to reduce pollution in Russian river and bay ecosystems. This validated source-to-sea management as useful for improved environmental management in the country. The pilot was seen as valuable for stimulating wider actions at the national and regional levels and pilots could be replicated in other Baltic Sea region countries, and further in Russia.

In South Africa, the Oceans and Coasts branch of the Department of Forestry, Fisheries and the Environment has greatly valued the source-to-sea screening study and are motivated to apply a source-to-sea perspective to try to reduce plastic pollution in its waterways. Action plans for plastic debris prevention in rivers are under development. However, a key challenge has been to convince the local authorities on the need to use the source-to-sea approach to improve their management of plastic waste. Instead of beginning with a mandate for them to initiate a new management approach, cost-of-inaction studies related to plastic debris are being developed. These will assess the cost of failing to manage the problem, which is expected to provide incentives to take action to avoid future losses and expenses.

In the Lake Hawassa sub-basin, the Rift Valley Lakes Basin Office has responsibility for implementing Integrated Water Resources Management (IWRM), developing a basin plan and setting up a forum for effective networking. The pilot in the Lake Hawassa sub-basin gave the Rift Valley Lakes Basin Office an opportunity to participate in the stakeholder engagement on the first three steps of the source-to-sea approach. This led to them funding an intensive technical training for 24 academics who were contributing to the development of individual sub-basin plans for the Rift Valley lakes and the Strategic IWRM Plan 2020-2035 for the entire Rift Valley Lakes Basin. The source-to-lake approach was included in the Strategic IWRM Plan as a complementary method to be used in conjunction with IWRM.

The awareness of the source-to-sea nature of challenges in the Vu Gia-Thu Bon River basin has grown through piloting the source-to-sea approach, initially in relation to hydropower and more recently to address plastic leakage and prevent marine litter. This has led to the willingness to use the source-to-sea approach to support the development of an action plan for plastic waste for Hoi An, a city in the river basin. The action plan will need to address source-to-sea linkages since mis-managed plastic in upstream communities can be carried downstream to Hoi An.

#### 4.1.3 Building on existing relationships

Identifying opportunities for source-to-sea management in locations where there are existing institutional relationships or coordination processes can facilitate more rapid uptake and

implementation. SwAM, for example, has chosen to do these studies where it has strategic bi-lateral partners as part of its international cooperation.

In the Lake Hawassa sub-basin, SIWI had an ongoing programme to provide capacity building to the Rift Valley Lakes Basin Office and the national Basin Development Authority. This previously established relationship provided a foothold for introducing the source-to-sea approach. Additionally, GIZ had an established programme in the Lake Hawassa sub-basin through its Natural Resources Stewardship Programme (NatuReS), a continuation of the International Water Stewardship Programme (IWaSP). Under this project, they formed a multi-stakeholder platform with an active Task Force addressing sediment erosion and one looking at plastic pollution and solid waste management in the sub-basin. These two task forces provided expertise and commitment that could be drawn upon in the project. Partnering with the Rift Valley Lakes Basin Office and NatuReS provided the convening power needed to bring together active and knowledgeable local stakeholders who could provide detailed local knowledge. By involving these and other stakeholders in the structured process of the source-to-sea approach, the foundations for source-to-lake management have been initiated in the Lake Hawassa sub-basin.

The Vu Gia-Thu Bon River basin was selected because it provided an excellent opportunity to pilot the source-to-sea approach due to a strong commitment to tackle the marine litter issue from national and provincial governments. The pilot was implemented with IUCN, which had a long-standing history of working to improve coastal and marine management in the basin. Their strong relationships with local and regional government authorities and ties to the Interprovincial Joint Coordination Committee ensured that workshops were well attended by government officials, including the Vice Chairman of the Provincial Peoples Committee from Quang Nam province. This helped anchor the source-to-sea approach in the basin and has opened the door to supporting the development of an action plan on plastic waste.

#### 4.1.4 Framing source-to-sea management to support achievement of global policy commitments

The strength of the source-to-sea approach is its ability to home in on priorities that span across the social, economic and environmental dimensions of the broader 2030 Agenda. The absence of a cohesive approach to achieving the 2030 Agenda for Sustainable Development (2030 Agenda) and lack of political commitment to work together on the Sustainable Development Goals (SDGs) in a coherent manner is stalling progress. Source-to-sea management can play an important role in ensuring that the linkages between the different goals, and their targets, are considered directly; particularly for SDG 6: Clean Water and Sanitation; SDG 13: Climate Action; SDG 14: Life Below Water and SDG 15: Life on Land. Doing so will help balance upstream and downstream demands and make sure that investments toward achieving of one of the SDGs does not impede the achievement of others. This is also true of other global priorities. For example, provision of clean water and sanitation contributes to human health and well-being. Other development priorities such as ocean health, ecosystem restoration, biodiversity and poverty alleviation can also be addressed through the cross-sectoral nature of source-to-sea management. The contribution that source-to-sea management makes to global priorities and sustainable development overall is one of the main opportunities for increasing its adoption.

Source-to-sea management allows for open dialogues to be held, linking across geographies and sectors, improving the success of policies, planning and investments. Source-to-sea systems are



often transboundary in nature which further demand inclusion of a range of perspectives. Addressing development challenges posed by climate change, losses in biodiversity and global crises such as the Covid-19 pandemic need targeted action. Source-to-sea management stimulates coordination that is needed to address these broad issues. Through this holistic management approach, these broad issues can be brought together into the same view, leading to the identification of innovative solutions that deliver multiple benefits.

The value of source-to-sea management has been highlighted in funding strategies of the Global Environment Facility (GEF) and the Swedish International Development Cooperation Agency (Sida); in operational strategies of UN Environment, UNDP Water and Ocean Governance Programme and SwAM; and in ministerial declarations/outcome documents from World Water Forum and the 2018 Dushanbe High-Level International Conference on the International Decade For Action "Water for Sustainable Development, 2018-2028". The German Federal Ministry for Economic Cooperation and Development (BMZ) and SwAM have funded activities contributing to implementation of the source-to-sea approach in countries including Viet Nam, Ethiopia, South Africa, Russia, China and Sweden. Opportunities to establish source-to-sea management are increasing with these and other global and national level policy and financial commitments. There is an increasing number of ongoing and planned projects that are addressing source-to-sea challenges. As these projects develop, they will contribute to growing the knowledge base and developing capacity for source-to-sea management.

## **4.2 Challenges**

The call for source-to-sea management and awareness raising about the need for and benefits of this management approach arises from the recognition that current management approaches do not adequately address the linkages in source-to-sea systems. This occurs in part because governance is fragmented, most often focusing on one segment of the source-to-sea system or on one sector. Communities addressing issues related to source-to-sea challenges also tend to work in isolation. Few demonstrate an interest in the complete source-to-sea system from the onset and instead tend to focus action on individual segments. This fragmentation, persistence of siloed approaches and potential complexity involved in overcoming them are both the key drivers creating the need for source-to-sea management as well as the most challenging factors that constrain its uptake.

### **4.2.1 Complexity**

Source-to-sea systems are complex. Even managing one part of a source-to-sea system, e.g., terrestrial, freshwater, coastal or marine environments is already challenging enough. To expand the management mandate to be inclusive of the entire source-to-sea continuum further complicates management decisions. Current approaches to environmental protection and development on land, along rivers and, coastal zones, and in marine environments fail to achieve sustainable development. This is partly due to limited understanding of how ecosystems are linked and the consequences of actions in one part of the source-to-sea system on other parts. The key flows that link ecosystems are being altered by a complex series of drivers and processes such as climate change, population growth and development decisions.

In addition to this complexity in the biophysical system, there is complexity in the social and governance systems. Stakeholders in a source-to-sea system can be geographically distant and

come with very diverse perspectives. Stakeholders can be defined by economic sectors, environmental interests, or may represent cultural or indigenous groups or be subsistence users reliant on ecosystem services provided by the source-to-sea system. Governance can also be complex, with many different authorities having responsibility for one or more segments of the source-to-sea system. This can sometimes include overlapping or conflicting mandates. Gaps in governance can also occur, further frustrating a coherent approach to management across the source-to-sea continuum. Authorities are often focused on one sector, e.g., energy, agriculture, water supply or urban development, with no single party addressing the source-to-sea system holistically. Achieving positive outcomes in source-to-sea systems requires an approach to analysis, planning, policy- and decision-making that considers the entire social, environmental and economic system from the river basin to the coastal area and even to the sea or open ocean (Granit et al., 2017). Mechanisms are rarely in place to bring together stakeholders and public authorities in a manner that enable such a holistic approach and support upstream-downstream cooperation and cross-sector coordination.

#### 4.2.2 Fragmentation

Management mandates, jurisdictions, and stakeholder interests are often limited to a specific part of the source-to-sea system. This makes it difficult to engage stakeholders and authorities to take steps toward source-to-sea management. While the source-to-sea system is one connected whole, the social and governance systems are fragmented. Stakeholder perspectives can often be localized with little recognition of the costs and benefits that exchange across the source-to-sea system. Public authorities tend to have a single focus informing their decisions and activities, leading to limited consideration of the impacts of their decisions on other sectors or segments of the source-to-sea system. Financial systems also tend to follow economic borders, often focusing on a specific sector or social geography, thereby limiting the assessment of risks and benefits that could incentivize upstream measures that deliver downstream benefits. Despite the multitude of environmental, economic, and social benefits that different parts of society receive from healthy source-to-sea systems, there are limited incentives for countries or municipalities to invest in measures that may primarily benefit ecosystems beyond their borders without financial mechanisms to bridge actions and benefits.

#### 4.2.3 Silos

A holistic perspective from source-to-sea, coordinating the implementation of the freshwater SDG 6, the climate SDG 13, and the ocean SDG 14 along with the land SDG 15, is a pre-condition for maintaining the healthy land-freshwater-marine ecosystems required for sustainable development. However, the communities working toward each SDG and even specific targets under the Goals are often working in silos, with little interaction or coordination with each other. This lack of shared agendas, processes, and targets persists at all levels of government. It can also be seen in NGOs and civil society organizations that tend to focus on a specific segment of the source-to-sea system or an individual issue. With competition for resources between government sectors and between non-governmental organizations, there are continual challenges to pool resources and combine efforts.

These three challenges – complexity, fragmentation and silos are not easily overcome. It takes more than one project or process using the source-to-sea approach to build momentum toward holistic source-to-sea management. Many of the drivers for these behaviours are structural in

nature as well as being the familiar way of doing things. Research is generally not oriented toward holistic perspectives and instead focuses on single topics within isolated disciplines. This makes it difficult to fully understand source-to-sea linkages or monitor changes over time. It also leaves a gap in terms of understanding how benefits, and costs, move both upstream and downstream across the source-to-sea continuum. Data collection and analysis is often done differently by each discipline, sector or within each segment of the source-to-sea system. No one holds a complete picture; in many cases it is impossible to compare and compile data collected in one source-to-sea segment or by one sector or discipline in such a way to piece together that complete picture. Without research and data to build a clear picture of the linkages from source to sea, stakeholders, public authorities, and the private sector do not have the basis for making informed, science-based decisions. Changing this requires the commitment of resources, which have largely not been dedicated to holistic research and coherent data collection, monitoring and evaluation that can illuminate source-to-sea linkages.

## **5. Insights on the source-to-sea approach**

As described in Chapter 2, the source-to-sea approach provides a structured process to be undertaken in the design, planning, implementation, and evaluation of strategies, policies, plans, projects and programmes with the goal of supporting source-to-sea management. Source-to-sea management considers the entire source-to-sea system – stressing upstream and downstream environmental, social, and economic linkages and stimulating coordination across sectors and segments. The source-to-sea approach includes six steps through which linkages between source-to-sea segments and sectors are considered in order to identify and prioritize issues to be addressed across the source-to-sea system. The ultimate outcome of the source-to-sea approach is to establish source-to-sea management, i.e., management that addresses upstream and downstream linkages across the source-to-sea system.

The analysis of how the source-to-sea approach was applied in the seven cases included in this report provides a first opportunity to gain insights on the approach itself as well as its application. Above, the opportunities and challenges in implementing source-to-sea management were discussed. Here, the strengths and limitations of the source-to-sea approach itself are presented. These insights can help direct resources and efforts toward developments that will strengthen the source-to-sea approach, making it a more valuable tool for achieving source-to-sea management and, ultimately, support sustainable development.

### **5.1 Strengths of the source-to-sea approach**

This section looks at strengths of the source-to-sea approach that could be found through the assessment of the five studies and two pilots projects. It focuses on seven dimensions that either enable its implementation or add clear value where it is applied.

#### **5.1.1 Applicable to a range of objectives**

The source-to-sea approach can be applied to desk studies as has been done in the five studies analysed in this report, in pilot projects as was done in *Foundations for Source-to-Sea*

*Management* or in a range of large or small policy development, planning and strategy processes. The five studies were primarily desktop assessments in which the source-to-sea approach was used to structure the analysis of primarily existing information. These studies were conducted by different teams, each of which had the opportunity to apply the source-to-sea approach to a unique local context and to meet specific objectives.

The two pilots undertaken in Lake Hawassa sub-basin and the Vu Gia Thu Bon River basin used the source-to-sea approach to structure the engagement of stakeholders in a bottom-up process that built up the knowledge base to be used in developing the theory of change during Step 4: Design. This knowledge base comprised of existing information, new material gathered through rapid assessment of local conditions, and stakeholder knowledge collected during stakeholder workshops. Each of the steps 1, 2 and 3 was undertaken together with stakeholders to raise their awareness of the source-to-sea challenge and to develop their capacity in the steps of the source-to-sea approach. Through this process, the two pilot projects were developing the foundations of source-to-sea management.

In the five studies, the source-to-sea approach structured the analysis of the existing knowledge of the biophysical, social and governance systems and provided a framework for developing a theory of change. Whereas the two pilots used the source-to-sea approach to structure the stakeholder engagement process that also led to the development of a shared knowledge base that can be used to design a theory of change that identifies the conditions of success. The source-to-sea approach can be applicable to a range of objectives whether applying it in a desk study or as a stakeholder engagement process. Already in this report, it is shown that the source-to-sea approach can be used:

- for comparative analysis of source-to-sea systems (Bohai-Baltic Seas);
- in a national river basin within the transboundary context of the Baltic Sea (Luga River);
- to stimulate interest in addressing a single issue at the local level (KwaZulu-Natal);
- to analyze the historical development of stakeholder engagement, management systems and governance (Göta River);
- in combination with life cycle analysis to understand impacts on coastal and marine areas (Three Archipelagos);
- in an endorheic lake basin and to feed into a lake basin plan (Lake Hawassa sub-basin); and
- to address an issue of national priority (Vu Gia-Thu Bon River basin).

Applying the source-to-sea approach to these different objectives ensured that upstream-downstream linkages, which usually would have been overlooked, were considered.

#### 5.1.2 Flexibility to address the source-to-sea readiness level

The source-to-sea approach has proven to be a flexible approach that can be adapted to the local context and the objectives of a study, project, priority-setting, policy, strategy or planning process or programme. This flexibility has been exemplified by the diverse applications presented in this report. These seven cases are the initial tests of the applicability of the source-to-sea approach; many more applications are yet to be explored.

One key aspect of the source-to-sea approach's flexibility is how it can be applied differently depending on the source-to-sea management readiness level. In the early stages of the source-to-sea management readiness level, the source-to-sea approach can be used to build awareness of the existence and nature of source-to-sea challenges and to begin collecting knowledge that can be the foundation for source-to-sea management. The Luga River and the KwaZulu-Natal at the local level are examples of using the source-to-sea approach to do a desk study that begins to introduce the source-to-sea nature of local challenges to stakeholders.

At moderate readiness levels, the source-to-sea approach is used to bring stakeholders together around a shared vision for the future and to elaborate a theory of change that will drive progress toward that desired future. This can be seen in the Bohai-Baltic Seas study, in relation to the recent development of the River Chief and Bay Chief systems. Having this new mechanism for coordination in place is a big step toward coordinated management, although operationalizing this innovation will take some time. The Lake Hawassa sub-basin and Vu Gia-Thu Bon River basin pilots are also examples of mid-stage readiness levels. In both cases, participatory processes with stakeholders were the basis for agreement around a shared vision for the future condition the source-to-sea (lake) systems.

In settings where there are higher readiness levels, the source-to-sea approach can be used to identify the gaps, limitations and barriers to implementation of source-to-sea management and to identify the steps needed to progress toward a more holistic, coordinated management of the source-to-sea system. The historical analysis of the Göta River demonstrated how source-to-sea management evolves over time, with the expectation for the condition of the source-to-sea system shifting towards greater environmental protection. While the source-to-sea approach was not strictly used during these developments, this retrospective analysis indicates that many of the elements of characterizing the biophysical system, engaging a broad set of stakeholders, advances in governance and setting targets for the condition of the source-to-sea system were undertaken over the years.

The six-steps of the source-to-sea approach follow the progression of commonly used project cycles, which makes the logic of the stepwise process easy to adopt for most stakeholders. As has been seen in the cases presented here, existing methods such as life cycle analysis, stakeholder power mapping and spheres of influence can easily be integrated into the approach.

### 5.1.3 Easy to adapt to the local context

The source-to-sea approach can be adapted to the local context and applied iteratively as the local context is better understood. The local context will determine where the focus will need to be to build the foundations for source-to-sea management. The source-to-sea approach provides a structured process that can be responsive to each unique situation and can be applied iteratively over time.

While the concept is called "source-to-sea" to encapsulate all landscapes and ecosystems through which water flows, the approach can be applied to specific segments of a source-to-sea system or expanded to include a sea and its entire drainage area. Like any framework for governance or management, the approach must be adapted to the local context. The source-to-sea approach proved useful in non-traditional 'source-to-sea' systems such as an endorheic lake basin in the Lake Hawassa sub-basin pilot. In many ways, applying the approach in the Lake Hawassa sub-basin mimicked a source-to-sea system on a much smaller scale, which simplified

the geographic breadth needed to understand the priority flows and their impacts. It made it possible to bring together stakeholders who had first-hand knowledge of the full source-to-lake system. In Three Archipelagos, the geographic area covered in the study was a portion of the Baltic Sea and did not follow the boundaries of a source-to-sea system.

The 'source' can also be interpreted within the context of the circular economy, e.g., the acquisition of raw materials and production of goods, etc. The Three Archipelagos study expanded views on the source-to-sea system in line with circular and life cycle perspectives and solutions. Here, the 'source' to 'sea' analysis was along the life cycle of boats from raw materials to end-of-life disposal and for biota included life histories of the species, fishing and processing. There is no apparent downside to applying the source-to-sea approach with different interpretations of 'source' (or even sea); it can be any system with up- and downstream linkages.

#### 5.1.4 Value of assembling a shared knowledge base

One strength of the source-to-sea approach lies in it providing a structured process that can help to organize what can often be voluminous amounts of information and complex processes. Where data and knowledge are limited, the source-to-sea approach can support the identification of the gaps in knowledge, collating what is known in a useful way to get progress started while more knowledge is developed through research, rapid assessment, studies, etc. Using the source-to-sea approach to engage stakeholders is an effective way to garner local knowledge, which can often complement or refine existing data and analyses.

Addressing all the key flows – water, biota, sediment, pollution, materials, and ecosystem services – and their alterations from source-to-sea is a monumental undertaking that could stall action indefinitely. Prioritizing amongst the flows and alterations can deliver focus that will enable quick action to deliver results in the short-term. Prioritization approaches used by each of the cases was discussed in Chapter 3 above. In the Bohai-Baltic Seas, Luga River and Göta River studies, the prioritization was criteria based. In the KwaZulu-Natal, Lake Hawassa sub-basin, and the Vu Gia-Thu Bon river basin, local priorities had already been identified. In Three Archipelagos, prioritization was done in consultation with the public authority. In all cases, this limited the extent of analysis needed during each step and helped focus the theory of change in the five studies. In the two pilots, through a small investment in rapid assessments it was possible to get a general picture of the priority flows in order to quickly identify the issues to explore with the stakeholders. This then provided direction in completing the stakeholder assessment and analysing the governance system. The assessments also highlighted priority areas for action to be taken for immediate results.

#### 5.1.5 Providing granularity to the stakeholder assessment

Participation of a range of upstream and downstream stakeholders representing different sectors needs to be secured to ensure successful application of the source-to-sea approach. By bringing together diverse stakeholders, sharing can lead to learning that leads to a more holistic understanding of the issues. Over time, this bottom-up engagement expands to include participation of all stakeholders needed to achieve locally identified desired outcomes. By following the source-to-sea approach, key stakeholders are brought together to address a problem that crosses physical and administrative systems.

The source-to-sea stakeholder categories are useful in stratifying stakeholder groups and providing more granularity to the understanding of the roles and responsibilities, spheres of influence and interests of each stakeholder. The source-to-sea categories, i.e., primary, targeted, enabling, supporting, and external, provide good insight into the stakeholder landscape. This increased granularity is valuable background that informs the elaboration of a more detailed and stakeholder-specific engagement plan. This engagement can cultivate the willingness to adopt elements of source-to-sea management. It can also clarify who is responsible for what, which can then be a basis for future development of an action plan or other management, governance, or investment activities.

The Luga River study and the Lake Hawassa sub-basin and Vu Gia-Thu Bon River basin were the only cases that actively engaged local stakeholders. The other studies evaluated stakeholders from existing knowledge. In the Luga River, two stakeholder workshops were held. One brought together local stakeholders in Luga Town that had intimate knowledge of the mid-section of the river while the other was held in St. Petersburg and included national level stakeholders. These two stakeholder groups had very different bases for understanding the Luga River issues and presented, in some cases, conflicting views. This underlines the importance of engaging a wide range of stakeholders to get a comprehensive picture of the source-to-sea system as well as to collect varying viewpoints.

The KwaZulu-Natal study demonstrates how bringing granularity to the stakeholder assessment can add more detail to the assessment and the engagement plan. By categorizing the stakeholders, i.e., primary, targeted, enabling, supporting and external, and using stakeholder assessment methods like power mapping and spheres of influence, the study was able to present a well-developed view of roles, responsibilities, interests, and potential engagement approaches for each stakeholder.

Working closely with a broad cross-section of community members in the Lake Hawassa sub-basin, ranging from local fisher people to representatives of local and regional government, development partners, and NGOs working in the region allowed SIWI to gather knowledge about the sources and impacts of sediment and plastic waste, key issues of concern, limitations that are stalling progress and activities that are proving successful. Getting this range of perspectives provided a strong basis for identifying future interventions. For example, the critical importance of working with farmers and pastoralists to support the planting of grasses that strengthen soil structure rather than weaken it was highlighted. Engaging a broad range of stakeholders using the source-to-sea approach can reveal a full palette of perspectives that creates a comprehensive picture of both challenges and opportunities.

In both Ethiopia and Viet Nam, participants were quick to highlight the role that the tourism sector is playing in the proliferation of plastic bottles in waterways. In both locales, hotels were highlighted as hotspots for producing plastic waste. But they can also take steps to prevent plastic pollution while benefitting from its reduction. Through the stakeholder identification activities in the workshops, Ethiopian Airlines, who is eagerly trying to promote Hawassa as a tourist destination, and tour boat operators in Hoi An were identified as having vested financial interests in seeing the situation improve.

In implementing the source-to-sea approach, it is important to engage marginalized and vulnerable populations who may be able to share unique insights and perspectives that will

enhance the viability of solutions. In both the Lake Hawassa and Vu Gia-Thu Bon basins, the informal sector provides a valuable service in collecting and recycling of plastic waste, e.g., PET bottles. When holding stakeholder workshops in Hawassa, the less formalized management structures made it possible to engage a representative from an informal recycling enterprise. This more complete understanding establishes a foundation for identifying the elements that need to be considered in an action plan that will lead to the desired outcome.

#### 5.1.6 Expanding understanding of the governance system

Completing a baseline analysis of the instruments and institutions governing behaviours and practices related to priority flows, their alterations, and impacts quickly conveys the need for upstream-downstream cooperation and cross-sectoral coordination. For example, when mapping current environmental values and ongoing activities, it is beneficial to consider the inputs coming from outside the area into the selected system boundary. The source-to-sea approach can showcase the importance of knowing the legal frameworks and the mandates, roles, and responsibilities of different authorities. This can be critically important in cases, e.g., in marine spatial planning or processes done at the municipal level where it is useful to underscore and demonstrate the linkages between land, freshwater, coastal, and marine areas and to normalize consideration of these linkages. Establishing a clear view of governance across these linkages, its gaps, overlaps, strengths, and weaknesses can highlight how necessary it is to coordinate across the source-to-sea system and to not only work within the boundaries of a marine protected area, a municipality, or other locality within a source-to-sea system.

The governance analysis done for the Bohai-Baltic Seas and Luga River studies highlighted the complexity of the governance system, specifically between sectors and across governance levels. Figure 4 from the KwaZulu-Natal study shows the gaps, overlaps, and transition from one authority to another along the source-to-sea continuum. The retrospective governance analysis presented in the Göta River shows how governance evolves over time, initially being quite locally focused and gradually expanding to include more of the source-to-sea system, including its international aspect as part of the Baltic Sea basin. In Three Archipelagos, that governance analysis looked across the life cycle of boats and life histories of fish and identified key gaps.

Understanding the complexity of the governance landscape is critical to addressing source-to-sea challenges. For example, in Viet Nam, the Ministry of Natural Resources and Environment (MONRE) has the primary responsibility for environmental management, pollution control and waste management. However, the Ministries of Construction, Agriculture and Rural Development, Health, Finance, Planning and Investment, Transportation, and Science and Technology all have mandates that contribute in some way to how plastic waste is managed. Furthermore, significant quantities of plastic waste are swept downstream from upstream rural communities that have little or no waste collection services. This plastic waste affects downstream communities that have higher collection rates but suffer the consequences upstream failures. This indicates the need to reach across governmental sectors and geographic segments to solve the plastic waste issue.

The sources of sedimentation to Lake Hawassa are related to land use changes such as conversion to agriculture, grazing, logging for charcoal making, and sand and gravel mining; it is evident that no one sector can deliver the solution. For example, while deforestation is happening in upland areas regulated by the Ministry of Environment, Forest and Climate Change once deforested, the land use is changed to agriculture and grazing – the domain of the Ministry of



Agriculture and Rural Development. Deforestation is being driven by the need for charcoal, which is sold to many urban dwellers to use as their primary source of fuel, tying in the Ministry of Water, Irrigation and Energy<sup>1</sup>. While none of these ministries have a direct mandate for controlling erosion, they each need to contribute to solving this problem. Potentially, these governance gaps may serve as an opportunity for anchoring source-to-sea management, as little is in place to impede its implementation. Lack of coordination mechanisms and management structures may make way for good governance systems to be installed.

#### 5.1.7 Building agreement on the way forward

Using the source-to-sea approach to build an understanding of source-to-sea challenges can increase awareness of the geography of the priority flows, stakeholders, and governance and provide insights into the networks of connection between issues, stakeholders, instruments and institutions. Together, these provide the foundations for designing strategic interventions that will change behaviours and practices such that the desired future condition of the source-to-sea system can be achieved.

Involving stakeholders in the process of designing a theory of change helps clarify their vision for the future and the long-term impact that is sought after. With that goal in mind, stakeholders can identify the behaviours and practices that must change for the desired future condition for the source-to-sea system to be achieved. Once these behaviours and practices are clearly described, the diagnosis of the governance system can be used to determine the gaps in the enabling conditions. At times, the actions needed to address a specific challenge may appear obvious to some. However, going through this stepwise process of analysing the biophysical, social and governance systems and using this analysis to develop the theory of change will most often illuminate previously unexplored avenues. In some cases, smaller, intermediate outcomes that collectively improve the overall status of the system can also initiate a momentum toward larger, or more complex, actions. With these small steps of progress in realizing the theory of change, stakeholders begin to see the benefits of upstream-downstream cooperation and cross-sector coordination in addressing source-to-sea challenges.

The knowledge base formulated in Steps 1, 2 and 3 can help identify the root causes of the observed negative impacts from alterations in the key flows. In the Vu Gia-Thu Bon basin, a more detailed assessment of waste disposal and collection in urban, rural and coastal settings was critical to understanding how and where plastic leakage occurs. In one coastal community, plastic waste was piled up along the sea wall and informal interviews with locals revealed that waste collection services simply were not available. Rather than having litter and garbage pile up around their houses, throwing trash over the sea wall presented the preferable alternative. To change this behaviour, it is necessary to understand the root causes. In this case, the fees paid for waste collection services were not sufficient to make it financially feasible to provide them with the regularity needed, therefore residents were left to burn or illegally dispose of their own waste. By understanding this, targeted activities can be undertaken that will begin the process of reducing the detrimental impacts of the alterations in the priority flows.

Likewise, to design intervention strategies to stop the flow of sediments to Lake Hawassa it was first important to have a full inventory of all the major sources of sedimentation and the

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<sup>1</sup> Names of ministries at the time of project engagement. Names and mandates may have changed.

behaviours that lead to soil erosion. Through this understanding it was easier to break the problem down into related but smaller interventions to bring about specific changes in practices. One such smaller intervention, that may have otherwise been overlooked, is the role that sustainable energy can play in saving Lake Hawassa. Eighty-four per cent of total energy demands are met by burning wood, much of which is harvested from local shrublands and woodlands, weakening overall soil structure. This highlights an important role for the Ministry of Water, Irrigation and Energy in developing alternative sources of energy that can reduce the reliance on charcoal.

## 5.2 Limitations of the source-to-sea approach

As with any newly developed approach, the source-to-sea approach has its limitations and its critics. The analysis for the seven cases has highlighted three main limitations: the lack of an evidence base demonstrating the benefits of the source-to-sea approach; a limited number of resources to guide its application; and challenges to engage some stakeholders.

### 5.2.1 Evidence-base of the benefits with the source-to-sea approach

The most frequently noted weakness of the source-to-sea approach is the limited examples of its implementation 'in practice'. Before investing in implementing this new approach, public authorities, donors, and others would like to see the results of fully elaborated cases where the full six steps of the source-to-sea approach were applied within an overall environmental governance system. It would be convincing to be able to list "source-to-sea actions" taken in a specific context and the results achieved to improve the conditions in a source-to-sea system and related services provided to the beneficiaries living there. Cases that include details on the measures formulated through the source-to-sea approach and evidence of their results on the management of a source-to-sea flow is currently lacking. Developing cases where the benefits of applying the source-to-sea approach are evident are still needed. Such an evidence-base would help those assessing whether to undertake an application of the source-to-sea approach.

The short history of source-to-sea programming quickly reveals that there is not a single case where all six steps of the source-to-sea management approach have been done within a project, much less applied at a national level. That is not, however, an indictment or limitation revealing any flaws in the concept, approach, or its guidance materials. It instead highlights the relative youth of the source-to-sea approach and the importance of considering phases of application as demand and opportunity arise.

### 5.2.2 Availability of resources to guide application of the source-to-sea approach

A further limitation in the source-to-sea approach, again related to its relative youth, is that there is yet to be a wealth of guidance, training materials and other resources developed to assist those who are interested in applying it. This lack of supporting materials can hamper the uptake of the source-to-sea approach. These materials can be developed over time, providing more direction in its application. One example of where this already exists is the publication of the *Source-to-sea framework for marine litter prevention: Preventing plastic leakage in river basins* (Mathews and Stretz, 2019) in which the source-to-sea approach is applied to the pollutant flow of marine litter. Lessons learned from the pilots in the Lake Hawassa sub-basin and the Vu Gia-Thu Bon River basin have been documented (see *Lessons from the Field*, SIWI 2020) and over time these lessons will be further elaboration as results from cases can be compiled and analysed.

### 5.2.3 Ability of key stakeholders to fully engage in the six steps of the source-to-sea approach

Engaging the full range of upstream-downstream and sectoral stakeholders can be problematic due to the limitations of time and resources for participation in a comprehensive bottom-up process of decision making. This can lead to either missing key stakeholders in the process or to stakeholders dropping out before the six-step process is completed. Depending on the specific context, stakeholders may need to be involved at critical points within the broader source-to-sea approach, to ensure their perspectives are included. In many locations, engaging stakeholders in decision making at all can be unfamiliar and even counter the local cultural context. It may be necessary to take small steps toward inclusion of an ever-widening circle of stakeholders. In these locations also, if stakeholders have not been previously engaged in decision making, it may take some effort to convince stakeholders of the value of participation and to secure their commitment.

There are different ways of addressing this limitation. Depending on the context, activities can be geared specifically at increasing stakeholder commitment to the process (such as in the case of the cost-of-inaction studies undertaken in South Africa). Another option is to apply the source-to-sea approach in a way that reduces the need for stakeholder engagement, by having desktop reviews and draft recommendations produced by experts that have or engage with local expertise to verify findings. While the latter option would limit some of the advantages of the source-to-sea approach, it would allow for applying it in contexts where funding or time constraints render it impossible to secure significant stakeholder engagement throughout the process.

## **6. Recommendations for building momentum to accelerate adoption of source-to-sea management**

The analysis of the seven cases presented in this report has been useful for understanding the opportunities and challenges for implementing source-to-sea management. It has also provided insights into the strengths and limitations of the six-step source-to-sea approach. While there was not a case that has completed the entire six-steps of the source-to-sea approach or demonstrated measurable benefits to the source-to-sea system from implementing priority actions, the cases do provide sufficient evidence that there is added value in applying the source-to-sea approach to address source-to-sea challenges.

As has been shown by the analysis of the cases, the six-step source-to-sea approach is relatively new and will continue to evolve. Given the value that can come from holistic management of source-to-sea systems, investment in such development appears to be well founded. This investment will reap benefits by unlocking the barriers to implementing source-to-sea management. In the first instance, investment should be made in building up a larger library of cases that will demonstrate the benefits of source-to-sea management. Beyond this, several areas would be particularly informative and supportive of reaching the goal of managing land, freshwater, coastal, and marine environments from source to sea.

The analysis of the seven cases provides the basis for recommendations on next steps toward a broader adoption of source-to-sea management. These recommendations are organized around the four Strategic Aims of the S2S Platform for building momentum in adopting source-to-sea management.

**Strategic aims for building momentum in adopting source-to-sea management**

To achieve greater adoption of source-to-sea management, four strategic aims have been defined through an extensive multi-stakeholder process undertaken by the [Action Platform for Source-to-Management](#) (S2S Platform). These aims form the basis for the [S2S Platform Strategy for the 2021-2025](#) (Figure 10) period.

- Strategic Aim 1: Strengthening Partnership Across Actors and Initiatives
- Strategic Aim 2: Growing Understanding
- Strategic Aim 3: Building Commitment for Source-to-Sea Action
- Strategic Aim 4: Taking Action on the Ground

The S2S Platform is a network of organizations committed to promoting, implementing and building expertise on source-to-sea management – bridging knowledge, policy and practice. The S2S Platform’s vision is a world in which land, freshwater, coastal, and marine ecosystems are managed holistically, balancing benefits for the environment, communities and economy from source to sea. Through individual and joint activities, it demonstrates the value of addressing persistent and rising issues such as climate risk adaptation and mitigation, declining biodiversity and marine pollution – from source to sea.

Achieving these four strategic aims will go a long way to building momentum to greater adoption of source-to-sea management. The focus here is to motivate uptake of source-to-sea management at the regional, national, and sub-national levels (Figure 10).

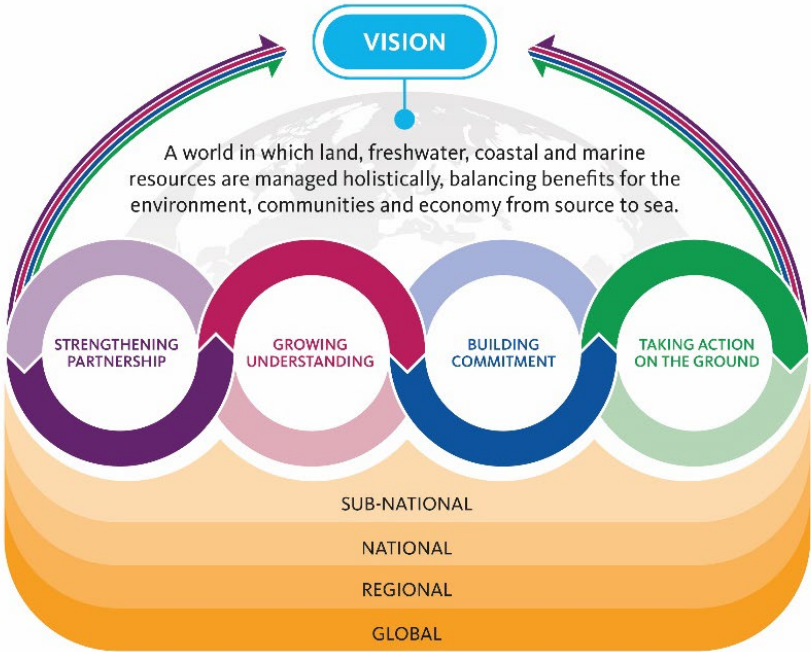


Figure 10: Theory of change from the Action Platform for Source-to-Sea Management (S2S Platform) Strategy 2021-2025 in which activities contributing to the Strategic Aims undertaken at the global to sub-national levels will lead to achieving the S2S Platform vision.

## 6.1 Recommendations around Strategic Aim 1: Strengthening partnerships across actors and initiatives

Achieving holistic management of land, freshwater, coastal and marine resources that balances benefits for the environment, communities, and economy from source to sea relies on using the collective and individual strengths of a diverse community including multilateral agencies, financing institutions, national governments, regional entities, non-governmental organizations, research institutions, and private sector with a stake in source-to-sea issues.

As can be seen throughout this report, the implementation of the source-to-sea approach occurs in specific locations and is relevant to a particular local context. Engagement of regional, national and sub-national actors, whether from the public sector, businesses, civil society or academia, is needed to achieve the aims of holistic management from source-to-sea. It is therefore critical that these types of actors also are well-represented as part of the broader knowledge exchange to learn from, support and further develop guidance on source-to-sea management.

**Recommendations** around Strategic Aim 1: Strengthening partnerships across actors and initiatives:

1. **Diverse and inclusive partnerships** for achieving greater adoption of source-to-sea management. The focus should be on raising awareness of the benefits of source-to-sea management, sharing examples of the required enabling environment through dialogue between regional, national and sub-national actors, and supporting the uptake of source-to-sea management in a broader set of countries.
2. **Supporting exchange of lessons learned** from the application of the source-to-sea approach and successes in establishing source-to-sea management between governments facing similar issues and with the broader source-to-sea community.
3. **Improving understanding of key bottlenecks** in establishing source-to-sea management and identifying potential avenues for addressing them, whether it be through, e.g., development of enabling conditions for source-to-sea management at the local, national, or even global levels, or targeted capacity development to enhance implementation of source-to-sea management.
4. **Influencing and contributing to policy processes** at the global, regional, and national levels through the mobilization of regional, national, and sub-national actors facing source-to-sea challenges that can bring location-specific experiences to the development of these policies.

## 6.2 Recommendations around Strategic Aim 2: Growing understanding

Source-to-sea management starts with understanding the benefits of addressing development challenges from source to sea. This requires a strong knowledge base of its merits and challenges, the barriers to implementation, and means to overcome them.

The seven cases presented in this report clearly indicate the importance of substantiating the need for and benefits of source-to-sea management. The capacity to manage source-to-sea linkages is still limited in most contexts, partly due to knowledge gaps on how impacts and benefits move across the source-to-sea continuum. Gathering and sharing knowledge, building an evidence-base gained through relevant research, and monitoring of outcomes from actions taken to address source-to-sea challenges, and developing guidance on addressing source-to-sea challenges are all needed. While this will be an ongoing process over time as the application of the source-to-sea approach expands and the demand for source-to-sea management grows, we have following recommendations based on a number of immediate needs that are reflected in the seven cases:

**Recommendations** around Strategic Aim 2: Growing understanding:

- 1. Building the evidence-base of benefits and bottlenecks in source-to-sea management.** Building a library of cases and lessons learned from implementation in different contexts and capturing innovations with successful results. This report and the seven cases included are the first entries into this library of cases. To advance learning more quickly, new cases should also be shared and undergo analysis to draw out insights, lessons, and innovations. This objective analysis can support the further development of the source-to-sea approach and inspire others to apply it in their local contexts. This will also facilitate the adoption of source-to-sea management.

Cases can be reviewed to identify key success factors enabling source-to-sea management, as well as approaches to engaging upstream-downstream stakeholders and cross-sectoral coordination that can be used by others. Collecting and sharing such examples can benefit those who are hesitant to embark on applying the source-to-sea approach or are resistant to source-to-sea management because they are unsure of how it works or the benefits it can offer. Real world examples will demystify what is intended and confirm that taking steps toward source-to-sea management is pragmatic when facing source-to-sea challenges.

- 2. Enhancing knowledge on source-to-sea linkages in the biophysical, social (stakeholders) and governance systems.** Holistic management of source-to-sea systems needs to be founded on science that describes the characteristics of the source-to-sea challenge and provides greater understanding of source-to-sea linkages. Research needs to be directed toward areas that are needed to inform science-based policies, management and investments that create benefits for the whole source-to-sea system. Data collection, analysis and monitoring needs to be done in a manner that provides a coherent view of the source-to-sea system and enables tracking of source-to-sea impacts and benefits.
- 3. Elaboration of the opportunities offered by source-to-sea management** to address key global challenge areas of priority to countries, including climate adaptation/mitigation, biodiversity conservation and poverty alleviation. This is needed to build commitment to source-to-sea management and could help shape interventions to tackle such key global challenge areas in a more holistic manner.
- 4. Developing guidance on the application of the source-to-sea approach in diverse settings** and in response to key development challenges. The application of the source-to-sea approach in the seven cases included in this report has highlighted that additional guidance would be beneficial in strengthening the application of the source-to-sea approach and supporting its application to new issues and contexts. Continuing to develop and enhance advice on the application of the source-to-sea approach would support its uptake in more locations. Having these materials would also support capacity

development efforts of regional, national, and local stakeholders. This would be valuable to continue to develop and enhance the advice available on the application of the source-to-sea approach.

- Further elaboration of methodological guidance on how to complete the different steps of the source-to-sea approach (Mathews et al., 2019) would help support a broader application of the source-to-sea approach, ideally complemented with examples of how to use existing methods and tools as part of its application. This guidance can also propose how each step can be applied depending on the source-to-sea management readiness level.
- More context and/or issue-specific guidance for source-to-sea key flows (e.g., water, sediment, biota or specific pollutants) could be developed to support application of the source-to-sea approach as part of specific planning processes (e.g., development of a solid waste management plan).
- Methods can be developed for analysing trade-offs and optimization of benefits across the source-to-sea system that can be used to inform decision-making processes. This can support the development of policies, strategies, plans and investments that capture source-to-sea system-wide benefits and avoid unintended negative consequences. These analytical methods can be used, e.g., within stakeholder dialogues to explore a range of potential actions or by investors when evaluating proposed projects.
- Developing a bottleneck analysis to assess the current level of source-to-sea management readiness and what might stifle progression to more advanced readiness levels. The analysis would identify the barriers that are hampering the progression toward fully evolved source-to-sea management. Categories of bottlenecks would be explored and potential interventions that can resolve these bottlenecks could be proposed. This analysis could be applied when there is the recognition that a source-to-sea challenge is being faced but it is unclear how to progress toward source-to-sea management.

### **6.3 Recommendations around Strategic Aim 3: Building commitment**

Global priorities as set out in the UN Sustainable Development Goals, the UNFCCC process, and highlighted through e.g., the UN Decade of Ocean Science and the Decade of Ecosystem Restoration will not be fully met without progress toward holistic management of land, freshwater, coastal, and marine ecosystems. Increasing the adoption of source-to-sea management requires commitments from governments, financiers, private sector, and civil society to address development challenges from source to sea. However, the adoption of source-to-sea management faces barriers and challenges that need to be addressed to smooth its implementation.

As shown by the cases reviewed in this report, there are barriers that limit the ability to address source-to-sea challenges and may frustrate the engagement of upstream-downstream stakeholders and coordination between sectors. To break through these barriers, we have the following recommendations regarding key areas to raise in agenda and priority setting processes.

#### **Recommendations around Strategic Aim 3: Building commitment**

- 1. Building commitment for incorporating source-to-sea perspectives into prominent global, regional, and national policy processes** is needed to meet obligations on e.g.,

sustainable development, water, ocean, biodiversity, and climate. Issues tackled at these higher levels of policy development can guide actions to be taken at local levels. Similarly, experiences at the local level, drawing from the local context and its priorities can feed into the design of national, regional, and global agendas and tracking mechanisms. An important feature of this work involves raising awareness of the benefits of addressing source-to-sea linkages through holistic management. Clarifying what is required in the enabling environment for source-to-sea management in dialogue with regional, national, and sub-national actors and investing in these can strengthen the impact of global commitments.

- 2. Substantially expand commitments to finance source-to-sea initiatives.** While some commitments to finance source-to-sea projects have been made, e.g., the Global Environment Facility (GEF), this needs to be substantially expanded. Both bilateral and multilateral donors need to recognize that sustainable development hinges upon taking source-to-sea linkages into consideration and creating the enabling environment for source-to-sea management. The possibilities of going beyond the often sector-specific objectives of funding strategies need to be increased to enable financing of cross-sectoral and system-wide actions. Private philanthropy can also contribute by recognizing the need for source-to-sea management to reach their issue-specific goals and including source-to-sea perspectives in their funding strategies.
- 3. Funding programmes for research need to include research topics that address critical knowledge gaps** on source-to-sea linkages in the biophysical, social (stakeholders), and governance systems. Further investment is needed to support data collection, analysis and monitoring systems that provide coherence across the source-to-sea system. This is an important enabling condition for source-to-sea management. Norms for data that enable comparability across source-to-sea segments and sectors and allows for tracking the key source-to-sea flows, their alterations, and the impacts from these is a requirement for getting a complete understanding of source-to-sea challenges. Addressing these challenges can be reinforced by monitoring of changes to the key flows and impacts of alteration only if collected data is comparable across the whole system. At the global level, initiatives such as the UN Decade of Ocean Science and the UN Decade of Ecosystem Restoration should encompass aims and activities that address the research needed to support source-to-sea management.
- 4. Building finance mechanisms and enabling environments that incentivize investment in measures that improve upstream/downstream ecosystems.** Addressing development challenges requires finance that is not limited by economic borders, specific sectors, or social geographies and includes assessment of risks and benefits across the source-to-sea continuum, evaluates trade-offs, and fosters new forms of collaboration. Currently, financing practices shy away from considering upstream-downstream impacts maintaining focus on specific sectors or segments of the source-to-sea system. Eliciting commitments from financial institutions to review investments with a source-to-sea lens is crucial for accelerating the adoption of source-to-sea management.

## **6.4 Recommendations around Strategic Aim 4: Taking action on the ground**

Commitments made at global, regional and national levels must be followed by actions taken to address source-to-sea challenges. The seven cases presented in this report demonstrate that even limited applications of the source-to-sea approach show where and how next steps can be taken toward source-to-sea management. As the source-to-sea approach is applied in more locations, the benefits of applying it in response to local priorities in a variety of contexts will be easier to demonstrate (as indicated under Strategic Aim: Growing Understanding). Hence, there



is a virtuous cycle whereby demonstrating the benefits of the source-to-sea approach leads to more applications, which leads to stronger evidence of its benefits.

#### **Recommendations** around Strategic Aim 4: Taking action on the ground

- 1. Demonstrating the benefits of the source-to-sea approach in addressing development challenges** through its practical application to achieve more source-to-sea actions on the ground. Sharing the evidence base and knowledge products produced under Growing Understanding with local, national, and regional actors and feeding experiences from the application of the source-to-sea approach into the development of these knowledge resources. The seven cases point to the need to adapt source-to-sea interventions and their objectives to the “maturity or readiness level” for source-to-sea management in any given context. Objectives of engagement can vary significantly between cases such as where there are stakeholder demands indicating the need to apply a source-to-sea approach, but limited knowledge of source-to-sea linkages and their impacts, as compared to cases where there is substantial knowledge on source-to-sea linkages and where policy priorities already identify the need for source-to-sea action, but there is limited capacity to act on these priorities.
- 2. Raising awareness on source-to-sea challenges, the source-to-sea approach, and the need for source-to-sea management** at all levels of government and with the private sector, academia, and civil society. The demand for source-to-sea management will increase as such awareness is raised at local to national and regional levels.
- 3. Developing capacity to address source-to-sea challenges through the use of the source-to-sea approach.** Capacity development among public, private, and civil society actors to address upstream-downstream linkages and facilitate cross-sectoral coordination will increase local, national, and regional expertise and spur movement toward source-to-sea management. Initial understanding of the capacity development needs amongst different parties would provide a basis for designing training approaches and content. Providing a range of training modalities will support broader engagement in these capacity building activities. Training programmes can target specific source-to-sea challenges, as well as particular contexts or perspectives for those challenges. It can also be modified to match the current source-to-sea management level and support movement along the readiness continuum.
- 4. Taking concrete steps to address source-to-sea challenges through projects, policy, strategy, planning or other decision-making processes.** The source-to-sea approach can be applied to develop a shared understanding of the source-to-sea challenge, come to agreement on a vision for the desired future and design a theory of change that proposes the conditions for success. This can then lead to establishing the enabling environment and achieving the desired changes. Each time a source-to-sea challenge is addressed by accounting for source-to-sea linkages and aiming toward holistic source-to-sea management, new lessons will be learned. Through monitoring and evaluation, the evidence base for the benefits of source-to-sea management can grow.

## **7. Conclusions**

The seven cases presented in this report were the first to apply the source-to-sea approach following the publication of *Implementing the source-to-sea approach: A guide for practitioners* (Mathews et al., 2019). As such, they have helped to illuminate some key factors related to its implementation.

**Holistic:** A main driver for the uptake of source-to-sea management is global sustainable development, water, climate, biodiversity, ocean health, and poverty alleviation priorities. Achieving global goals around these priorities which are often interlinked will be facilitated through source-to-sea management, and likely, they will not be met without it.

**Collaborative:** All seven cases had a link to an ongoing process, e.g., a planning process, partnership platform, or multi-stakeholder dialogue. This highlighted that source-to-sea assessments will be more effective when they are anchored in existing or necessary decision-making or engagement processes that can benefit from a source-to-sea perspective.

**Prioritizing:** Both the studies and the pilots were undertaken with limited funding and time, which clearly indicates that benefits can accrue from the source-to-sea approach even in short-term engagements. In part, this value is achieved through prioritization of the key flows to be addressed but is also inherent in the integrity of the source-to-sea approach.

**Participatory:** Source-to-sea challenges that arise from the alteration of key flows drive the need for source-to-sea management. Recognition of the source-to-sea nature of these challenges is a key opportunity to introduce source-to-sea management. Once this need is identified, piloting the source-to-sea approach and building activities on existing relationships can help bring people together and motivate participation in addressing the source-to-sea challenge.

**Context dependent:** The variations in the local contexts for the seven cases brought to light that there is a progression of readiness levels for source-to-sea management. These readiness levels, ranging from being newly introduced to the need for source-to-sea management to well-developed stakeholder engagement and coordination mechanisms, help determine how the source-to-sea approach will be applied and how to benchmark progress.

**Results oriented:** The seven cases show the value of assembling a shared knowledge base and the benefits of having more granularity to the stakeholder assessment. The progression through the steps is quite useful in designing a way forward through the development of a shared vision and action plan toward the desired future.

**Adaptive:** The cases demonstrated the flexibility of the source-to-sea approach to be adapted to the local context and issues. The cases also included novel approaches and merged the source-to-sea approach with already existing methods that strengthened the analysis carried out over the six-step approach.

The recommendations provided in this report will expand the community of actors engaged in source-to-sea management, whether at the level of awareness raising and advocacy or all the way to being leaders in implementing source-to-sea management. They point to the need to enlarge the pool of knowledge about source-to-sea systems and increase the guidance on applying the source-to-sea approach to diverse issues and settings. Increased commitments to invest in the enabling environment for source-to-sea management as well as to fund source-to-sea projects are called for. Awareness raising, capacity development and support for taking action on the ground are further essential ingredients to accelerate the benefits received through holistic management from source-to-sea.

## References

Action Platform for Source-to-Sea Management. 2021. Strategy 2021-2025.

<https://www.siwi.org/wp-content/uploads/2021/01/Action-Platform-for-Source-to-Sea-management-Strategy-2021-2025.pdf>

Granit, J., Liss Lymer, B.; Olsen, S., Tengberg, A; Nömmann, S.; Clausen, T. J. (2017): A Conceptual Framework for Governing and Managing Key Flows in a Source-to-Sea Continuum. *Water Policy*.

HaV. 2019. Source-to-Sea - Screening study of pollution and flows in KwaZulu-Natal, South Africa. NIRAS International Consulting with GroundTruth, South Africa. Havs- och vattenmyndighetens rapport 2019:15

Mathews, R.E. & Stretz, J. 2019. Source-to-Sea Framework for Marine Litter Prevention: Preventing Plastic Leakage in River Basins. Stockholm: SIWI. [https://www.siwi.org/wp-content/uploads/2019/08/Marine-Litter-Prevention\\_2019\\_WEBB.pdf](https://www.siwi.org/wp-content/uploads/2019/08/Marine-Litter-Prevention_2019_WEBB.pdf)

Mathews, R. E., Tengberg, A., Sjödin, J., & Liss-Lymer, B. 2019. Implementing the source-to-sea approach: A guide for practitioners. SIWI, Stockholm. [https://www.siwi.org/wp-content/uploads/2019/07/Source-to-sea-guide\\_webb.pdf](https://www.siwi.org/wp-content/uploads/2019/07/Source-to-sea-guide_webb.pdf)

Nordzell, H.; Almlöf, K.; Juhlin, M.; Kaal, M.; och Wahtra, J. 2020. Source-to-Sea metoden applicerad på material (från båtliv) och biota (fisk) - Underlag till Huvudrapport Tre Skärgårdar.

SIWI. 2020a. Foundations for Source-to-Sea Management: Case Study – Lake Hawassa. J. Weinberg, Mathews, R. E., Hebart-Coleman, D. [https://www.siwi.org/wp-content/uploads/2020/06/Case-Study-Hawassa\\_WEBB.pdf](https://www.siwi.org/wp-content/uploads/2020/06/Case-Study-Hawassa_WEBB.pdf)

SIWI. 2020b. Foundations for Source-to-Sea Management: Case Study – Vu Gia-Thu Bon River Basin. R. E. Mathews, Groeneweg-Thakar, K. [https://www.siwi.org/wp-content/uploads/2020/06/Case-Study-Viet-Nam\\_WEBB.pdf](https://www.siwi.org/wp-content/uploads/2020/06/Case-Study-Viet-Nam_WEBB.pdf)

# Annex

# Summary and analysis of reports

## The Bohai and Baltic Seas from a Source-to-Sea Management Perspective

### Overview

The purpose of this study was to develop an 'initial knowledge base' on opportunities and challenges for source-to-sea management in the Baltic and Bohai Seas through a comparative analysis of the source-to-sea management systems of the Baltic and Bohai Seas. The analysis prioritized alterations in phosphorus and nitrogen; hydropower dams; and plastic leakage for further investigation. Based on this analysis, it identified opportunities for dialogue between Chinese and European partners for knowledge exchange and joint research to address common challenges.

### Key findings in the study region

The study noted enabling conditions (opportunities) and challenges for source-to-sea management in each region.

#### In the Bohai Sea Region:

Key enablers include: (1) high national priority on environmental protection; (2) institutional reforms to improve coordination between government bodies; (3) capacity to manage the entire source-to-sea system within a single country.

Key challenges include: (1) new institutional arrangements take time to operate at full capacity and are under high pressure with current reforms even before working to bring in new approaches (2) integration of bottom-up components of the source-to-sea approach within historic top-down governance procedures; (3) intense environmental pressures and large, complex administrative structures due to China's large scale.

#### In the Baltic Sea Region:

Key enablers include: (1) common policy structures between Baltic Countries (except Russia) through the EU Water Framework Directive; (2) established networks and cooperation infrastructure between Baltic countries, including HELCOM; (3) high public awareness of the prioritized issues; (4) intensively studied and monitored environmental state.

Key challenges include (1) coordination between 14 countries, not all with same laws as the EU countries; (2) competing interests between countries and sectors; and (3) responding to areas where EU water and marine framework directives are not aligned.

### Key findings on the source-to-sea approach

The source-to-sea approach with the application of the key flows enables a clear and coherent visualization of similarities and differences of prioritized environmental challenges

Initially scoping of the analysis during a brainstorm or workshop, quickly covering all included steps. Based on this, the analysis can then be elaborated iteratively, preferably again covering all steps in each iteration, rather than focusing on one step at a time. This will enable the practitioners to adapt more easily to the needs identified during the process.

Table 3: Review of the Baltic and Bohai Seas Report

Organization/author	IVL, Chinese Research Academy of Environmental Science, SIWI
Local organizations	Chinese Research Academy of Environmental Science
Assessment Scope	Desk study with direct expertise and authority in case study area
Target audience	Authorities in China, Europe and Baltic Countries interested in initiating a source-to-sea dialogue or assessment
Report Objective	Provide 'initial knowledge base' on opportunities and challenges for source-to-sea management in Baltic and Bohai Sea
Output	50 page report; journal article published in Water International Special Issue on Source-to-Sea Management
Geography (region/country)	Baltic Sea Region (Northern Europe) Bohai Sea Region (China - Northeastern region)
Geographic scope	Bohai Sea: Catchment area 1.3 million km <sup>2</sup> and 200+ million people; Baltic Sea: Catchment area 1.7 million km <sup>2</sup> and 85 million people
Source-to-sea flows reviewed	All
Source-to-sea priority flows assessment	Pollutants, Materials (which also addresses sediment, biota). Priority flows were selected based upon common challenges to both Baltic and Bohai Seas; having large impact/challenge; and showing different aspects of source-to-sea challenges.
Source-to-sea priority sub-flow assessment	Yes - Plastic, Nutrient (Nitrogen/Phosphorus), Hydropower  Sub-flows were chosen to provide more focus to the analysis. Hydropower as a materials sub-flow was selected since it impacts the key flows of sediment and biota
Source-to-sea steps covered	1, 2, 3, 4
Source-to-sea steps conducted in field	None
Additional documentation	No
Key learnings/ findings	Yes
Recommendations	There are many documented areas to take or support actions found within the elaboration of the theory of change in Step 4; but these are not provided as recommendations or in a way stating how to use the result. The final section includes "opportunities" and "challenges" which point to enabling conditions that can support a source-to-sea approach at a general level. It does not point specifically at what to do

	to address challenges, and the opportunities are not specific opportunities for a directed action. There is no recommendation based upon the finding of the overall assessment done in steps 1-4.
Next steps indicated	Ideas for next steps can be found from close reading of the sections on the theory of change but there is not a conclusive and directly applicable guidance for any measures or actions to be taken as result of the study conducted.

Table 4: Qualitative assessment of strengths and limitations

Categories	Description
Achievement of Objective	The study identified issues and did a good desk review assessment of the priority sub-flows, stakeholders and governance. Opportunities and challenges identified, however, were more features of the governance system in each basin that can make actors in those regions more or less receptive to initiating a source-to-sea intervention. It did not provide a knowledge base on the opportunities and challenges for implementing source-to-sea approaches to address each sub-flow clearly.
Novelty/ innovation	It is the first comparative study of two basins looking at similar flows with the intention of supporting knowledge exchange and potential twinning
Value to practitioners	Most interesting feature was articulation of Theory of Change; and structure of study that served almost as pre-study for planning or dialogue on source-to-sea approach uptake in a region.
Value to local stakeholders	The comparative study may be of some interest to the relevant authorities in China and in Baltic Region; and could be used to inform exchanges for deeper exploration. Value of governance assessment could be validated by asking authorities/ stakeholders in each region.
Specificity of recommendation	There are no direct recommendations made, but potential actions are outlined within the theory of change. The conclusions on challenges or opportunities describe more elements of the enabling (or disabling) environment to be receptive to a source-to-sea approach on a more general level; not specific opportunities for actions to be taken to manage flows better.
Feasibility of next steps/ uptake of actions	There are no direct recommendations made, but potential actions are outlined within the theory of change. The conclusions on challenges or opportunities describe more elements of the enabling (or disabling) environment to be receptive to a Source to Sea approach. That cooperative actions and dialogue continue are likely as next steps but specific new investments or interventions that would result are not clear.

Learning and capacity development of participants	The study included regional/national authorities (CRAES) conducting review of flows using the source-to-sea approach
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Table 5: Qualitative assessment by step performed

Characterization	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Included a brief overview assessment of all flows in both basin areas;</li> <li>- Provided an overview of three prioritized sub-flows and at least one key issue/source per sub-flow per system.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- The characterizations were short and broad.</li> <li>- Brief overview on the amount of nutrient pollution, numbers of hydropower plants, and general description on plastic litter; but does not characterize in detail the impacts, causes/drivers etc., of flows</li> </ul>
Engagement	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Brief overview assessment of key stakeholders in both basin areas for environmental management of the source-to-sea system in each region.</li> <li>- Provided a list of enabling, targeted, and primary stakeholders per sub-flow, per region with at least short description of their role.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- The result is a list of organizations or stakeholder groups, doesn't add detail on how to engage which organizations for what purpose.</li> <li>- This would serve instead as an input to begin a source-to-sea dialogue process or project activities only.</li> </ul>
Governance Diagnosis	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Provides an overview of relevant governing institutions across the source-to-sea system overall, and then within the sub-flows selected.</li> <li>- Provides lists of relevant authorities, measures, initiatives, of each area</li> <li>- Provides diagram showing institutional linkages/ responsibilities in China across physical systems across source-to-sea continuum.</li> <li>- Highlights which policies and measures are most relevant to sub-flow in each region.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- For the most part, does not assess gaps, coordination issues, or points where action should be focused (through reform, new laws, improved implementation).</li> <li>- Does not produce a 'baseline' analysis, or review challenges or means implementation of key policies to be improved/ considered through source-to-sea approach or action.</li> <li>- Does not provide guidance for theory of change or interventions directly.</li> </ul>
Design (theory of change)	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- The theory of change is presented for each flow and is easy to follow.</li> <li>- The column "changes in behaviour" provides a sensible list of priority areas for measures to address to improve management of each sub-flow area that can be acted upon.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- The 'enabling conditions' lists areas most directly connected to actions to be taken but are very broad and do not provide specific guidance.</li> </ul>



	<ul style="list-style-type: none"><li>- The theory of change diagrams are provided per flow but not per region; over-simplifies the assessment and loses quality of analysis found in text.</li><li>- Few measures/issues raised require or involve source-to-sea approach, or addressing gaps that happen due to lack of coordination between authorities across source-to-sea system. Most relate to source prevention in plastics, hydropower management and nutrient pollution.</li></ul>
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# Luga River and Bay in a Source-to-Sea Management Perspective

## Overview

This study applies the source-to-sea approach in the Luga River and the Luga Bay region of the Russian Federation. It looks at priority flows of wild salmon, nitrogen and phosphorus. The study identified opportunities and challenges to implementing source-to-sea management, as well as to potential measures to support local and national Russian stakeholders to reach goals within the HELCOM Baltic Sea Action Plan. The research includes a field visit to a fish hatching site and a farming village led by a local sustainable rural development expert, as well as two workshops held with stakeholders.

## Key findings in the study region

Nitrogen and phosphorus pollution in the Luga River, which also drains into the Baltic Sea, is a serious issue. Nutrient retention is low due to draining of local wetlands, and high pollution loads come from livestock farming, landfills and insufficiently treated wastewater in the region. To improve the control of nitrogen and phosphorus entering the Luga River and Bay, the study recommended:

- Clarify roles, obligations and requirements for coordination of different authorities at federal, intra-regional, regional and local levels
- Improve reporting/data collection on nutrient pollution from water users
- Invest in better control systems of farms and dwellings lacking wastewater treatment.
- Develop a coordination mechanism and a governance body that can take a source-to-sea view; and
- Stakeholders across the Luga River system to enable shared actions to control nutrient pollution.

Salmon is a critical resource to the commercial fishing industry but poaching, illegal fishing and habitat degradation are severe issues placing sustainable population stocks at risk. To improve the sustainable management of wild salmon, the study recommended:

- Create coordinated monitoring programme of salmon/fish populations using modern tools (e.g. eDNA analysis);
- Improve enforcement of poaching regulations through investment in human capacity, equipment and surveillance technology (e.g., drones);
- Invest in better wastewater treatment processes and management;
- Engage with local communities on actions that need to be taken to prevent damage to salmon habitats and benefits provided over time; and
- Set a new environmental target to reach 50% potential capacity for salmon reproduction by 2030

## Key findings on the source-to-sea approach

- Applying the source-to-sea approach to target a single fish species, in a relatively small community works effectively to arrive at a list of priority actions to be taken at community level to address an issue also found at a regional level (e.g., for salmon stock recovery in the Baltic Sea). This could be considered to create more detailed studies; or integrated in multi-level programmes that look at source-to-sea management actions at different scales.

- Adding a gender perspective as a component of source-to-sea studies, also raised in other studies, is recommended.

Table 6: Review of the Luga River and Bay Report

Organization/author	IVL, SIWI, Mineral
Local organizations	Mineral
Assessment Scope	Desk study, stakeholder workshops, and field visit
Target audience	Local authorities and community stakeholders and adds Baltic Sea Action Plan components etc. which targets more national/regional governance actors.
Report Objective	<ol style="list-style-type: none"> <li>1. Identify opportunities/ challenges to implementing source-to-sea management;</li> <li>2. Support local and national Russian stakeholders to reach goals within HELCOM Baltic Sea Action Plan and other goals;</li> <li>3. Support dialogue on advantages and challenges of the source-to-sea approach as a process to identify local solutions for river basins</li> </ol>
Output	Report 66 pages
Geography (region/country)	Luga River and Bay, Russia
Geographic scope	13600 km <sup>2</sup> , population of Luga is 40,000
Source-to-sea flows reviewed	All
Source-to-sea flows priority assessment	<p>Yes - Biota, Pollution.</p> <p>Four criteria were used for selection of priority flows: the alteration constitute major environmental challenges with economic and social relevance to the local communities; highlights different segments of the source-to-sea system; broadly reflects both local, national and global interests; is targeted by the Baltic Sea Action Plan (and relevant to cooperation between Russia and Sweden).</p>
Source-to-sea priority sub-flow assessment	<p>Yes - Wild Salmon, Nutrient pollution (Nitrogen/Phosphorus).</p> <p>Sub-flows were chosen more than flow, based on criteria above.</p>
Source-to-sea steps covered	1, 2, 3, 4
Source-to-sea steps conducted in field	1,2,3: The research team conducted one mission with a field visit to a fish hatching site and a farming village led by a local sustainable rural development expert, and two workshops one held with local community stakeholders and the other with national level stakeholders.
Key learnings/ findings	<p>Some insights are provided in the conclusions with indicated focus of action for each sub-flow.</p> <ul style="list-style-type: none"> <li>○ To restore wild salmon populations, local communities must be better informed of the economic benefits it brings as well as the actions that need to be taken to prevent damage to salmon habitats.</li> <li>○ An environmental target to reach 50% potential capacity for salmon reproduction by 2030 is suggested.</li> </ul>

	<ul style="list-style-type: none"> <li>○ A coordination mechanism and a governance body taking a source-to-sea view for the Luga River system could enable shared action on nutrient pollution.</li> </ul>
Recommendations	Recommended actions are found within the analysis of steps 3 and 4; and included in the summary but are not explicit.
Next steps indicated	See above, same answer

Table 7: Qualitative assessment of strengths and limitations

Achievement of Objective	The paper framed opportunities to address challenges through source-to-sea management more than it specified opportunities for implementation of source-to-sea management. It did specify some areas of focus for source-to-sea interventions related to the selected sub-flows. The paper showed alignment of areas of action with Baltic Sea Action Plan.
Novelty/ innovation	Included gender as mainstreamed component; aligned with regional governance frameworks (e.g. HELCOM) in addition to local, national etc. Included a mission and stakeholder engagement sessions to produce inputs to analysis that was conducted within a short timeframe.
Value to practitioners	Interesting to look at how source-to-sea approach works when targeting a single fish species, in a relatively small community. Some insights on adding gender as a component of source-to-sea study, also found in other studies.
Value to local stakeholders	Due to the relatively small size of the catchment and single issue targeted of salmon, the mapping, analysis and steps included should be useful to inform actions and priorities. For nutrient pollution, the highest value areas are the stakeholders identified and governance analysis. Actions recommended are fairly broad and potentially already known.
Specificity of recommendation	Recommendations included both specific target setting and actions as well as broad improvements or development or new processes.
Learning and capacity development of participants	Capacity development of local stakeholders through the missions and workshop occurred. Leading organizations (IVL, SIWI) have experience with implementing source-to-sea programmes.

Table 8: Assessment by step performed

Characterization	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Brief overview assessment of all flows and then provided an overview of two prioritized sub-flows.</li> <li>- Considered geographic segments relevant to sub-flows in analysis and situations in each segment.</li> </ul>
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	<ul style="list-style-type: none"> <li>- For salmon, divided assessment in line with issues resulting in altered state (e-g habitat destruction, poaching); nutrient pollution covers a variety of relevant issues.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- Does not document priorities of issues altering nutrient pollution flow.</li> </ul>
Engagement	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Clear list of enabling, targeted, and primary stakeholders per sub-flow, with at least short description of their role that was created with inputs from relevant parties in workshops.</li> <li>- Included a gender analysis.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- The list of stakeholders doesn't add detail on how to engage which organizations for what purpose.</li> <li>- Does not document in this section which stakeholders engaged highlighted particular requirements or perspectives to enable source-to-sea management or improved management of flow in question.</li> </ul>
Governance Diagnosis	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Provides list of relevant governing institutions for the sub-flows</li> <li>- Due to the relatively smaller scale of system, could provide lists of relevant issues and identify gaps for each flow that included inputs from local stakeholders.</li> <li>- List of gaps provided for nutrient pollution is specific and clear.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- A similar list of gaps per issue for salmon could have been made.</li> <li>- The list of issues/gaps highlighted could be more directly integrated into design analysis.</li> </ul>
Design (theory of change)	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- For the most part, the relatively confined scale of the Luga River and Bay allows for sufficient analysis of issues across source-to-sea system for each flow and targeted measures to be outlined.</li> <li>- The division of the sections under 'issues' (e.g. habitats, poaching) helps make assessment more concrete and structured.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- When expanded to include Baltic Sea for nutrient pollution the overall relevance is somewhat lost, could highlight instead total potential contribution to Baltic through lessened loads from Luga River system.</li> <li>- Should refer more in both areas on engagement of key stakeholders identified in step 2, this is where the most useful 'source-to-sea' analysis is provided; for salmon in particular without this it highlights useful priorities and measures but does not show added perspective/value given from source-to-sea process to do this.</li> <li>- Should have more focus on pollution as issue for salmon as it is raised as key in later outcomes.</li> </ul>

# Screening Study of Pollution and Flows in KwaZulu-Natal, South Africa

## Overview

The report provided a source-to-sea assessment that indicates areas for action and options that the Department of Forestry, Fisheries and Environment, South Africa (DFFE) could consider in interventions to manage solid waste and plastic pollution flows. It analysed key flows, stakeholders and governance aspects relevant to good water management in the uMngeni lower catchment region in the province of KwaZulu-Natal.

## Key findings/recommendations in the study region

A detailed list of proposed strategies for institutional, economic, social, and biophysical or structural interventions are provided to improve source-to-sea management of solid waste and plastic pollution.

- Recommended focus to improve enabling conditions in four areas (1) Well informed and harmonized leadership in policy and practice; (2) Higher commitment, accountability and active engagement in solid waste management from Source to Sea; (3) Improved knowledge and capacities in sustainable watershed management; (4) Aligned incentives for responsible consumption and production.
- Seven types of interventions were recommended, including list of stakeholders to involve or execute the action (1) Coordination platforms; (2) Innovative communications platforms; (3) Trainings; (4) Workshops; (5) Awareness building and education; (6) Public participation meetings; (7) Market-based and non-market-based incentives for solid waste management and adoption of green technologies and innovations.

## Key findings on the source-to-sea approach

- Recommendations provided through source-to-sea framework analysis can effectively outline actions to be taken and specific groups to be involved in their execution.
- Creating additional structures within the source-to-sea analysis to categorize and specify recommendations by stakeholder, type of measure, and problem addressed can improve opportunities for effective engagement and implementation.
- A first source-to-sea analysis can be iterated in a stakeholder engagement process to validate and improve recommended actions and specific roles of different stakeholders to execute them.
- The study also provides interesting tools and matrices that can be emulated or replicated for stakeholder assessment, mapping and engagement strategy; and matrices/ diagrams used for linking intervention strategies to theory of change, with identified stakeholders, tools/methods.

Table 9: Review of the KwaZulu-Natal Report

Organization/author	Niras, Groundtruth
Local organizations	Groundtruth
Assessment Scope	Desk study, key expert inputs, some stakeholder/expert interviews

Target audience	Environmental authorities in South Africa (specifically, the DFFE and provincial, basin, and city authorities)
Report Objective	<ul style="list-style-type: none"> <li>- Support the Department of Forestry, Fisheries and Environment to use the source-to-sea approach analyse key flows, stakeholders and governance aspects relevant to good water management in the province of KwaZulu-Natal.</li> <li>- Provide a toolbox of options and information for decision-makers in the area to design future interventions, or to feed into their ongoing projects.</li> </ul>
Geography (region/country)	KwaZulu-Natal Province, South Africa
Geographic scope	uMngeni lower catchment region (population > 4,000,000) KwaZulu-Natal Province has population of > 11,000,000 people, and five major rivers. The study briefly assessed each river system but narrowed scope to lower catchment of one of these rivers.
source-to-sea flows reviewed	All
source-to-sea flows priority assessment	Yes - Pollution
source-to-sea priority sub-flow assessment	Yes – Solid waste and plastic Determined based upon impact on system partially, but more to align with existing priorities and feasibility to apply source-to-sea approach effectively as pilot.
source-to-sea steps covered	1, 2, 3, 4
source-to-sea steps conducted in field	None
Additional documentation	Yes Additional governance review of legislation and investments in field; GIS analysis performed for characterization step; stakeholder consultation inputs integrated into report. Figures and tables used for stakeholder analysis can be used in stakeholder engagement processes.
Key learnings/ findings	Yes This is done throughout the report, and in summary sections after each step.
Recommendations	Yes These are provided clearly within each section, and in line with each specific stakeholder.
Next steps indicated	Yes The report is a screening study to support a full source-to-sea intervention on solid waste and plastics, it provides final recommendations on first steps to do that and how to use findings of the report.

Table 10: Qualitative assessment of strengths and limitations.

Achievement of Objective	The report provided an assessment that indicates areas for action and options that the South African government (DFFE) could consider in interventions to management solid waste and plastic pollution flows.
Novelty/ innovation	Several elements were integrated into the study, notably the power mapping and sphere of influence into the stakeholder assessment and intervention strategy. Gap assessment and recommended activities per stakeholder, integration of stakeholder alignments within governance assessment also novel and useful. Additional GIS analysis and governance assessment done per flow and segment of source-to-sea system.
Value to practitioners	For practitioners, it provides several items that can be considered for adaptation/replication when performing a screening or pre-assessment to initiate a Source-to-Sea intervention or strategy in a location. Some of these include: governance assessment across segments of source-to-sea continuum, matrices used for stakeholder assessment, mapping and engagement strategy, matrices/ diagrams used for linking intervention strategies to theory of change, with identified stakeholders, tools/methods. Recommendation provided to verify and update stakeholder assessment using the figures and tables developed in the study can be tested.
Value to local stakeholders	The study was constructed as response to a demand from a government agency (DFFE, South Africa) on issue of relevance. Moreover, it provides details on specific gaps to address with interventions involving various stakeholders.
Specificity of recommendation	There is a very large number of recommendations provided but they are well categorized to show where to do what with whom so that they can be used as input to decide priority actions and begin an implementation process.
Feasibility of next steps/ uptake of actions	See above for explanation.

Table 11: Assessment by step performed

Characterization	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Overview assessment of all flows and then provided a reasoning for prioritization, and explanation of context provided by assessment of all flows within source-to-sea system.</li> <li>- Analysis of environmental, social, economic impacts and then assessment of drivers, sources, and physical locations of solid waste/plastic accumulation.</li> <li>- Use GIS imaging and spatial analysis to identify hotspots (instead of on-site assessment/ availability of existing data).</li> </ul>
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	<ul style="list-style-type: none"> <li>- Provided coherent summary of key flows, system boundaries, impacts, and action areas and locations to focus on.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- As screening study, new data not added; and no on-site assessment performed.</li> </ul>
Engagement	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Included a clear list of enabling, targeted, and primary stakeholders, with description of their role, detail on how to engage, and for what purpose.</li> <li>- Identified level of influence, interest and capacity of each stakeholder and sphere of influence mapping, used later to inform intervention recommendations.</li> <li>- Included expert assessment, stakeholder interviews, and locally knowledgeable consultant to do this.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- Assessment only, unable within study to perform engagement to verify or use analysis.</li> <li>- Not always clarified which analysis came from review, experts or interviews</li> </ul>
Governance Diagnosis	<p><u>Strengths:</u></p> <p>Provides assessment of governance mandates/ coordination issues across source-to-sea segments, and then for specific sub-flow of solid waste plastics.</p> <ul style="list-style-type: none"> <li>- Performed governance framework analysis from global to community level, including government and non-government actors, and identifying relevant source-to-sea stakeholder groups.</li> <li>- Provides governance gap and overlap assessment at stakeholder level, making interventions to address gaps more targeted.</li> <li>- Provided priority areas of focus for general governance interventions.</li> </ul>
Design (theory of change)	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Coherence of approach provides a useful model: Selected four overarching areas for providing enabling environment, and targeted behaviours they support in each of these areas. Linked this to types of interventions that support the enabling conditions, the stakeholders relevant to engage in these and factors to attract them to do so.</li> <li>- Followed theory of change analysis with clear summary list of recommended activity areas.</li> </ul>

# Source-to-Sea Management of Göta River - Historical Perspective

## Overview

This study analyses the development of water management in the catchment of the Göta River and its coastal waters from the first half of the 20th century until year 2020. The source-to-sea approach is applied to structure this analysis by identifying the activities which led to an alteration of the natural state of key flows and thereby to a deterioration of the natural systems, the stakeholders involved and their roles, the regulatory framework and how the combination of these factors impacted on the design and implementation of interventions to improve the environmental status of the catchment and its coastal waters.

## Key findings in the study region

The study showed that the improvement of wastewater treatment and the phasing out of mercury compounds in industrial processes resulted in a successful reduction of point source emissions. For non-point source, nitrogen emissions continue to decrease while phosphorus emissions remain at a similar level. The review highlighted several 'success factors' for point-source pollution control:

- Early involvement of local stakeholders in water management processes (including establishment of watershed associations)
- Governmental approach of open, transparent communication with targeted stakeholders
- Strict pollution control regulation
- Financial support to municipalities and industry

A key success factor for reducing negative impacts of hydropower on environment (and fish) was the adoption of the national plan for sustainable hydropower in 2019, and specifically the requirement for plants to apply for new permits and enable improved regulation and performance control.

Notable challenges to address in current management raised include:

- Old permits: Introduction of permitting is effective for regulation of pollution emissions, however, they face limitations to enforce additional improvements once a permit is granted. Permits for hydropower plants once given cannot easily be modified to lessen environmental impact.
- Development of more efficient, stricter approaches for diffuse pollution control and new funding to meet environmental targets
- Improvements of gender sensitive planning is in Swedish/EU water management

## Key findings on the source-to-sea approach

- The study validated that source-to-sea framework can be used to perform a historical review of linked changes of management and environmental status, which can be integrated more into the source-to-sea approach to develop case studies and learning materials.
- In future studies of this type, the governance diagnosis gaps that existed in different phases or times; and then measures/ changes that addressed and led to improvements for management of the sub-flow can be highlighted.

- Future studies could elaborate experiences that can be transferred to manage similar source-to-sea systems; and show gaps to be addressed based on historical review and current state.

Table 12: Review of Göta River Report

Organization/author	IVL
Local organizations	IVL
Assessment Scope	Desk study (historical review)
Target audience	Swedish environmental authorities, environmental professionals with deep interest in source-to-sea case studies
Report Objective	Draw insights from a case study of successful management approach to see ways in which it applied a source-to-sea perspective before the concept as such had been formulated, and key factors that led to improved environmental status.
Output	Report 112 pages
Geography (region/country)	Sweden
Geographic scope	Göta River, drainage basin area 50,200 km <sup>2</sup> . Largest river in Sweden, flows into the North Sea
source-to-sea flows reviewed	All Review of all flows including alterations, key locations, causes, impacts.
source-to-sea flows priority assessment	Yes – Pollution, Materials, Biota Criteria for selection of priority flow based upon linkages to development of source-to-sea system, demonstration of effective intervention strategies, and relevance to current environmental status.
source-to-sea priority sub-flow assessment	Yes - Pollutants: Nitrogen, Phosphorus, Mercury; Materials: Hydropower and fish
source-to-sea steps covered	1, 2, 3, 4
source-to-sea steps conducted in field	None* Historical review, based on literature and public documents.
Additional documentation	No
Key learnings/ findings	Yes Two set of findings are presented: 1. on the source-to-sea system of Göta River (overall, and for sub-flows); 2. on the source-to-sea approach, based upon review of Göta River/Swedish historical experience
Recommendations	No
Next steps indicated	No

Table 13: Qualitative assessment of strengths and limitations

Achievement of Objective	It demonstrated applicability of framework to do historical assessment and find success factors or barriers within management of source-to-sea system.
Novelty/ innovation	It is likely the first study to use the source-to-sea framework to do a historical analysis; and to focus on areas where the primary objective was to find success factors that can be learned from. Insight gained from historical source-to-sea framework gender analysis may lead to future investigations (showing that Swedish water management and EU Water Framework Directive not gender sensitive).
Value to practitioners	It is of high value to practitioners working on environmental protection of the Göta River, or responsible authorities in Sweden (e.g. HaV); and for practitioners/ government authorities to learn from a case study on environmental management of nutrient/mercury pollution and small/medium hydropower regulation. It validated that source-to-sea framework can be used to perform historical review of linked changes of management and environmental status, that can be integrated more into the approach.
Value to local stakeholders	Highly useful as historical analysis for managers to understand past and current state of affairs for management of Göta river. Potentially unlikely that new information or insights unknown to river managers were brought forth through the report; more likely those facts were validated by this report instead.
Specificity of recommendation	No recommendations are given, findings related to the source-to-sea system show specific success factors and most important single areas for improved pollution control, though these could likely have been shown through a traditional case study review on the topic as well.
Feasibility of next steps/ uptake of actions	No recommendations are given, findings related to the source-to-sea system show specific success factors and most important single areas for improved pollution control, though these could likely have been shown through a traditional case study review on the topics without source-to-sea framework.
Learning and capacity development of participants	Increased familiarity with the source-to-sea framework and its coherence with national and EU governance processes result from this case study. It is key for leading source-to-sea authorities such as SWAM to contextualize what is new, and what is similar to existing/previous practices in applying the source-to-sea perspective and frameworks.

Table 14: Assessment by step performed

Characterization	<p>Strengths:</p> <ul style="list-style-type: none"> <li>- Provides a historical review of alterations of key flows, their causes and impacts; with a useful summary table.</li> </ul> <p>Limitation:</p>
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	<ul style="list-style-type: none"> <li>- There is description of reason for selecting sub-flows and its key points/features; but this part is brief.</li> </ul>
Engagement	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Assessment of stakeholder groups within historical phases of the system where improvements were made done per flow.</li> <li>- Gender analysis demonstrated ways in which it could be performed with source-to-sea assessment, and highlighted historical deficit of gender assessment within Swedish/EU level water management frameworks.</li> </ul> <p><u>Limitation:</u></p> <ul style="list-style-type: none"> <li>- Does not give direct assessment of how new stakeholders were engaged (or institutions formed) that had role in change of state of system, or what can emulated, learned from based on this.</li> <li>- Was not able to find useful gender data (only able to note its absence).</li> </ul>
Governance Diagnosis	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Provides historical in-depth narrative (and timeline of key policies) of evolving legislation and institutional arrangements for management of sub-flows.</li> </ul> <p><u>Limitation:</u></p> <ul style="list-style-type: none"> <li>- It would have been useful to highlight directly in the governance diagnosis gaps that existed in different phases or times; and then measures/ changes that addressed and led to improvements for management of the sub-flow. This could lead into clearly highlighting where the current governance gaps or challenges are at present and how this is considered within governance system for the river.</li> </ul>
Design (theory of change)	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Provides an interesting analysis of historical enabling factors, key measures and institutions that gives detailed insight into situation of sub-flow in region.</li> <li>- Highlighted some historical legacy issues (e.g., hydropower permits governed by legislation enacted one century ago) to be addressed.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- The red line connecting the most important actions taken, and key steps done by specific stakeholders is not clear to follow in either section; it is more of a list of relevant factors/issues that occurred.</li> <li>- Nutrients and mercury could have been addressed separately to improve clarity in understanding the relevant drivers and actions highlighted.</li> <li>- Would have been interesting to assess where learnings from Göta could be transferred for management of other rivers; and to add gaps still to be addressed based on historical review and current state.</li> </ul>

# Source-to-Sea Metoden Applicerad på Material (Från Båtliv) och Biota (Kustfisk)

## Overview

This study tested the source-to-sea method to understand impact of boating and fishing industry and culture on the coastal and marine environment in the Swedish/Finnish archipelago (Tre Skärgård region). It is the only study to use the source-to-sea framework to look at boats as a sub-flow and make the "source" to sea connection with an adapted life-cycle analysis approach and broad consideration of a flow as a cultural/industrial process.

## Key findings in the study region

- Better resolution and greater transparency around existing data is needed.
- Fishing and boating industries are highly regulated but still have environmental impacts.
- Boating has impacts on marine, air, and soil quality (several management gaps are raised).
- Planning to enable a shift in norms and behaviours must be developed through long term strategies and engagement with stakeholder across the value chain.
- Bottom-up dialogue from lower levels of management to national to EU is needed.
- Regulations on fishing rights and permits should be reviewed and incentivize actions to take care of fishing stocks.

## Key findings on the source-to-sea approach

- The method outlined in the practitioner's guide provide structured assessment to an environmental management problem even if the geographic definition of "source" is changed.
- The structure of the analysis that divided assessment of each sub-flow into four categories that represent independent processes can be considered strongly as a good practice that can potentially be used in other projects. It also shows some strengths and limitations of the source-to-sea approach being applied to issues/places that do not exactly coincide with a source-to-sea system.
- Life-cycle analysis approach used for boats (from Raw Materials, Production, Use, End-of-Life) may be specifically assessed for plastics or other solid waste flows (which is most common flow considered across projects)
- Life-cycle analysis used for fish (biota) identified very similar issues and assessments of pressures on fish (nutrient pollution, overfishing, habitat degradation) in characterization. The value of this approach is found in steps 2, 3, and 4; which was able to categorize relevant stakeholders, institutions/regulations, gaps and required actions effectively. For example, the governance diagnosis linked relevant policies at EU, National, Provincial and Municipal level per life cycle stage in each flow provides a detailed, digestible overview that can be copied in other studies.
- The report also proposed that recommendations within the theory of change need to be evidence-based, which may require additional impact (or cost-benefit) assessment to be able to quantify the improvements made and aid decision-making.

Table 15: Review of Tre Skärgårdar Report

Organization/author	Tre skärgårdar (Anthesis, Digital Riktning, HaV)
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Local organizations	Tre skärgårdar (Anthesis, Digital Riktning, HaV)
Assessment Scope	Desk study
Target audience	Swedish environmental authorities, potentially boating and fishing industry in Sweden
Report Objective	Test the source-to-sea method to understand impact of boating and fishing industry and culture on the coastal and marine environment in the Swedish/Finish archipelago.
Geography (region/country)	Sweden/Finland/Baltic
Geographic scope	Coastal zone, Baltic Sea, Archipelago between Sweden and Finland
Source-to-sea flows reviewed	All Review of all flows including alterations, causes and impacts (not specific segments or geographical locations).
Source-to-sea flows priority assessment	Yes – Materials, Biota No criteria for selection of priority flow, pre-determined.
Source-to-sea priority sub-flow assessment	Yes – boating industry; fish
Source-to-sea steps covered	1, 2, 3, 4
Source-to-sea steps conducted in field	None* Literature review with subject expertise from authors
Additional documentation	No
Key learnings/ findings	Yes
Recommendations	Analysis within sections is well-structured; attempts to provide findings relevant to source-to-sea approach and specific to flows in the study region. General priorities and issues to consider to reduce environmental impact of boating, and environmental harm to fish are provided, together with some specific immediate actions.

Table 16: Qualitative assessment of strengths and limitations

Achievement of Objective	The report was performed in full, well-written and constructed etc. The ability of the approach to apply into the specific geographic setting had issues noted by the authors.
Novelty/ innovation	It is first study to use source-to-sea framework to look at boats as a sub-flow and make the "source" to sea connection with an adapted life-cycle analysis approach and broad consideration of a flow as a cultural/industrial process. It doesn't completely work in the same way to connect with a physical source to sea system, but does give insights.
Value to practitioners	The structure of the analysis that divided assessment of each sub-flow into four categories that represent independent processes can be considered strongly as a good practice that can potentially be used in other projects. It also shows some strengths and limitation of the source-to-sea approach

	being applied to issues/places that do not exactly coincide with a source-to-sea system. Life-cycle analysis approach used for boats may be specifically assessed for plastics flow (which is most common flow considered across projects).
Value to local stakeholders	For those involved in this specific region and fields of focus. Particularly the governance diagnosis, stakeholder mapping and recommendations on enabling environment.
Specificity of recommendation	No specific recommendations are given, and conclusions are fairly broad. However, recommended actions within stage 4 step 1, have fairly specific, tangible areas to policy makers to follow up on.
Feasibility of next steps/ uptake of actions	n/a
Learning and capacity development of participants	Based not on how much was learned, but relative influence of party conducting the study (e.g not an authority or large company themselves).

Table 17: Assessment by step performed

Characterization	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Review of all flows with alterations, causes, effects.</li> <li>- Adapted life-cycle analysis provided a source-to-sea context and useful insight into impacts that can be targeted in specific production and use phases of boats.</li> <li>- Highlighted some impacts of boating on other source-to-sea flows (e.g. sediments, fish etc.).</li> <li>- Life-cycle structure for fish, and problem-based assessment (Nutrient pollution, overfishing, habitat loss) created more targeted assessment.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- Defining the physical source-to-sea system or size of the area being considered (entire waters between Sweden/Finland? entire Baltic) creates some confusion.</li> </ul>
Engagement	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Identified stakeholders in each group, and categorized these into relevant life-cycle/problem process for boating and fishing. Included several specific entities (as well as general ones).</li> <li>- Included gender analysis.</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- Did not engage stakeholders (out of study scope), did not make evaluation of their role, interest, etc. of pathways to engage.</li> </ul>
Governance Diagnosis	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>- Diagnosis done by life-cycle stage, detailed with laws/responsibilities by jurisdiction level (EU, National, Province, Town), followed by narrative analysis of key regulations, and level of regulation of each step and gaps.</li> </ul>
	<p><u>Strengths:</u></p>



Design (theory of change)	<ul style="list-style-type: none"> <li>- Categorization with actions to be taken for each life-cycle stage and per sub-flow, provide four key areas with tangible actions. Include, seemingly to extent possible, concrete actions together with overarching or more general ones (e.g., harmonize regulation).</li> </ul> <p><u>Limitations:</u></p> <ul style="list-style-type: none"> <li>- Generally biggest limitation is that no path/ recommendations for engaging stakeholders in clearly identified, although some challenges and directions are noted.</li> </ul>
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## Foundations for Source-to-Sea Management in Lake Hawassa Sub-basin, Ethiopia and Vu Gia Thu Bon River Basin, Vietnam

### Overview

The “Foundations for Source-to-Sea Management” project piloted the source-to-sea approach in two locations: the Vu Gia Bon River Basin, Viet Nam and the Lake Hawassa Sub-Basin, Ethiopia. The project worked with local experts and stakeholders to conduct the first three steps of the source-to-sea approach. In the Lake Hawassa sub-basin, two priority source-to-sea flows were identified as important – sediment from soil erosion and plastic pollution and in the Vu Gia Bon River Basin, Viet Nam worked with only plastic pollution.

### Key findings/recommendations in the study regions

#### *In Lake Hawassa, Ethiopia:*

**Lack of coordination between institutions and sectoral actors are primary obstacles to appropriate management of sediment and plastic pollution.** Challenges to coordinate mandates and actions are found both between the ministries as well as across the different levels of government (federal level, regional, state government and city administration).

**An action plan centered on sediment management** should be made and include all relevant actors and outlines various roles, objectives, and targets for each, within their respective mandates. Whilst the basin plan prepared by the RVLBDO or other plans prepared by the Regional States reference sediment concerns and responses, a standalone plan and agreement amongst key institutions is necessary to support coordinated actions in respect to their mandates.

**Increased oversight over environmental impacts of sandmining and fuelwood collection** is needed. Activities include increased monitoring, working with other institutions to identify suitable alternatives to wood fuel for domestic energy needs, and identifying appropriate resource zones for sand mining that minimise impact.

**Multiple priority areas are needed to curb plastic pollution.** Limited overall solid waste management capacity; weak local enforcement; and underinvestment in solid waste management collection and disposal facilities. Specific areas that require improvements include the disposal of medical waste from health centres, rural plastic waste collection and disposal, and leakage during collection and transport of plastic litter to local waste disposal facilities.

#### *In Vu Gia Thu Bon, Vietnam*

**One third of plastic waste is uncollected** in rural and coastal areas, much of which quickly becomes marine litter, leading to an annual total of 13,524 tonnes of uncollected plastic waste in the basin.

**Low solid waste collection and recycling rates in rural or low-density areas** are the leading cause of plastic pollution. Recycling rates of around 7 percent also require incentives, investment and engagement with the general public to increase dramatically.

**Overlapping roles and responsibilities** and in some cases, conflicting aims between responsible authorities led to poor coordination across ministries and their related provincial and district offices in implementing solid waste management

Key findings on the source-to-sea approach

The project published analysis targeted specifically to practitioners with insights on guiding practices in the application of the source-to-sea approach, which are shared below (Thakar & Mathews 2020).

- **COLLABORATIVE:** Build upon existing institutions, established methods and on-going processes by embedding source-to-sea thinking into what is already there.
- **CONTEXT-DEPENDENT:** Adapt the source-to-sea approach to be responsive to the local context and ensure local benefits are not gained at the expense of negative impacts elsewhere in the source-to-sea system.
- **PRIORITIZING:** Target one or more source-to-sea flows to address the issues that hold the greatest potential for generating positive impacts for the system.
- **PARTICIPATORY:** Engage upstream and downstream stakeholders from different sectors to raise awareness about the impact of human activities and stimulate bottom-up decision making.
- **HOLISTIC:** Address upstream and downstream linkages across issues, impacts, stakeholders, desired outcomes, costs and benefits.
- **RESULTS ORIENTED:** Target intermediate outcomes that contribute to overall improved economic, social and environmental status of the source-to-sea system.
- **ADAPTIVE:** Learn by doing through pragmatic implementation, monitoring, evaluation and adaptive management to allow for early detection of progress or impediments in achieving desired outcomes and allows for active course correction.

Table 18: Review of Foundations for Source-to-Sea Management in Lake Hawassa, Ethiopia and Vu Gia Thu Bon, Vietnam.

Organization/author	SIWI
Local organizations	Rift Valley Lakes Basin Authority, Ethiopia; Hawassa University; IUCN Vietnam
Assessment Scope	Project with missions, continued engagement with stakeholders; separate full studies for characterization, engagement and governance baseline.

Target audience	GIZ financed programme; local stakeholders and basin authority
Project Objective	<ul style="list-style-type: none"> <li>• Increase knowledge of priority local challenges constraining sustainable development;</li> <li>• strengthen awareness of the linkages between upstream and downstream activities and their impacts;</li> <li>• highlighted the opportunities and challenges associated with implementing the source-to-sea approach to management; and</li> <li>• built local capacity for taking a holistic approach to natural resource management and economic development.</li> </ul>
Geography (region/country)	<p>Lake Hawassa, Ethiopia (Lake Hawassa is 90 km<sup>2</sup> and the endpoint of an endorheic hydrological system, with some limited groundwater out ow)</p> <p>Vu Gia Thu Bon, Vietnam (Area of 10,350 km<sup>2</sup> , Quang Nam and Da Nang provinces, flows to South China Sea)</p>
Geographic scope	Endorheic lake basin region
S2S flows reviewed	Materials, Sediment
S2S flows priority assessment	Pre-selected as sediment, and materials (solid waste)
S2S priority sub-flow assessment	For materials, plastics.
S2S steps covered	1-3
S2S steps conducted in field	1-3
Additional documentation	Yes. There are extensive learning materials and information shared with stakeholders from this project. This includes: Characterization reports; stakeholder analysis study and templates; governance assessment analysis and templates; case study reports and lessons from the field. There are further videos, scientific papers, blogs, and articles.
Key learnings/ findings	Yes. Key learnings and findings on both the source-to-sea approach overall as well as key findings in the case study area are provided in separate documents.
Recommendations	Yes. Recommendations on both the source-to-sea approach and in the case study area based upon the source-to-sea analysis and engagement are provided in separate documents.
Next steps indicated	Yes. Recommendations for next steps are provided, and a second project is currently ongoing following up the first (with focus on plastic pollution in both sites).

Table 19: Qualitative assessment of strengths and limitations

Achievement of Objective	The project generally was able to achieve the objectives set out but was influenced by the outbreak of COVID and was not able to perform a final iteration of recommendations and agreed actions with stakeholders within the implementation period.
Novelty/ innovation	Innovations included adapting the S2S approach in a source-to-lake system and development of more detailed methods and frames for conducting characterization, engagement and diagnosis steps. Included first applied S2S project looking at sediments.
Value to practitioners	The project focused on capturing learning for practitioners and producing a 'toolkit' to accompany the S2S practitioners guide. This provided worksheets and templates for implementing steps of the practitioner's guide, including characterization assessments; stakeholder mapping and governance assessment templates. Also produced case study analysis and lessons from the field targeted for practitioners/ future project designers.
Value to local stakeholders	The project enlisted a new potential source-to-sea champion; a professor at Hawassa university. The project provided training on the source-to-sea approach and exercised focused on sediments/plastics with a group from Hawassa University. The project engaged and performed interactive sessions with a large number of local stakeholders. The project engaged with the national ministry in Ethiopia, who expressed interest in national level training and engagement in source-to-sea approach.
Specificity of recommendation	This score is moderate because the recommendations produced on both sediment and plastics were not iterated with the local relevant stakeholders as the final mission for the project was cancelled due to the pandemic.
Feasibility of next steps/ uptake of actions	A second phase of the project was commissioned, with focus on the development of shared accountability and local action plans for plastic pollution control.

Table 20: Assessment by step performed

Characterization	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>– Commissioned studies performed by local and international experts, including site visits and new data collection</li> <li>– Separate studies and reports produced per flow</li> <li>– Introduced analysis of sub-section connections in sediment flow characterizations</li> <li>– Included application/adaptation of marine litter assessment framework methodology</li> </ul>
Engagement	<p><u>Strengths:</u></p>

	<ul style="list-style-type: none"> <li>– Included multiple workshops and engaged with broad group of stakeholders</li> <li>– Performed structured stakeholder assessment per category</li> <li>– Included analysis of stakeholders’ physical location on S2S segment, interest and influence over flow</li> <li>– Produced template for stakeholder assessment that can be used in other project applications</li> </ul>
<p>Governance Diagnosis</p>	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> <li>– Two full reports (one per flow), built directly upon characterization and stakeholder assessment report</li> <li>– Included analysis of institutions, instruments and policies</li> <li>– Defined governance gap analysis in terms of capacity, enforcement, investment and coordination</li> <li>– Identified governance hotspot issues (e.g., types of waste, sandmining for sediments)</li> <li>– Included recommendations based on governance analysis</li> <li>– Created additional template for governance assessment</li> </ul>

# **Building momentum to accelerate adoption of source-to-sea management - Lessons learned and recommendations from seven case studies**

This synthesis report summarises and analyses conclusions from five case studies commissioned by SwAM and two pilot studies undertaken by SIWI focusing on application of source-to-sea management in a variety of locations, contexts, and issues. Learning from the seven cases, discussions during a practitioners' workshop and targeted interviews resulted in recommendations of what is needed to build momentum toward greater adoption of source-to-sea management. The recommendations include expanding the community of actors engaged in source-to-sea management, whether at the level of awareness raising and advocacy or all the way to being leaders in implementing source-to-sea management. The recommendations also point to the need to enlarge the pool of knowledge about source-to-sea systems and increase the guidance on applying the source-to-sea approach to diverse issues and settings. Further commitments to invest in the enabling environment for source-to-sea management as well as to fund source-to-sea projects are called for. Awareness raising, capacity development and support for taking action on the ground are further essential ingredients to accelerate the benefits received through holistic management from source to sea.

SwAM, The Swedish Agency for Marine and Water Management is the responsible government agency tasked to protect, restore and ensure sustainable use of freshwater resources and seas including fisheries management.