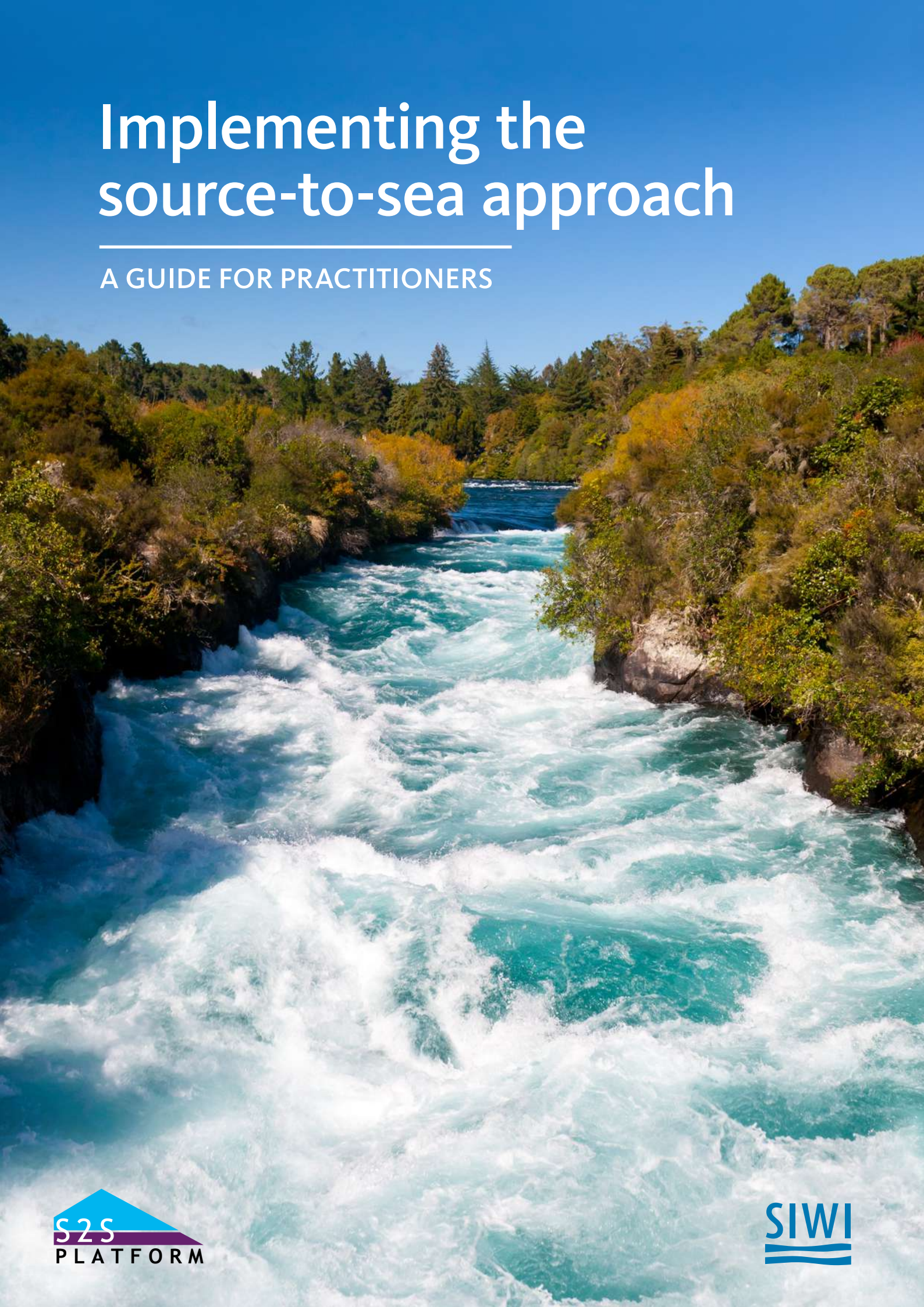
Implementing the source-to-sea approach

A GUIDE FOR PRACTITIONERS



S2S PLATFORM

SIWI

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Preamble

Only quite recently have we come to truly understand the many important linkages between land, freshwater and oceans. Generally, terrestrial, freshwater and marine specialists have tended to work independently from one another, with limited interaction. But with new insights into the complex relationship between different ecosystems – on land and in rivers, deltas, estuaries, nearshore and in oceans – comes a growing realization that a more holistic approach is needed. This guide describes the source-to-sea approach and its contribution to addressing key challenges for sustainable development. It takes practitioners through a six-step process for implementing the source-to-sea approach in projects and programmes (Figure 1). For each of the six steps, questions that direct the development of a source-to-sea project or programme, background information on the step, a relevant case study and the expected output of the step are presented.

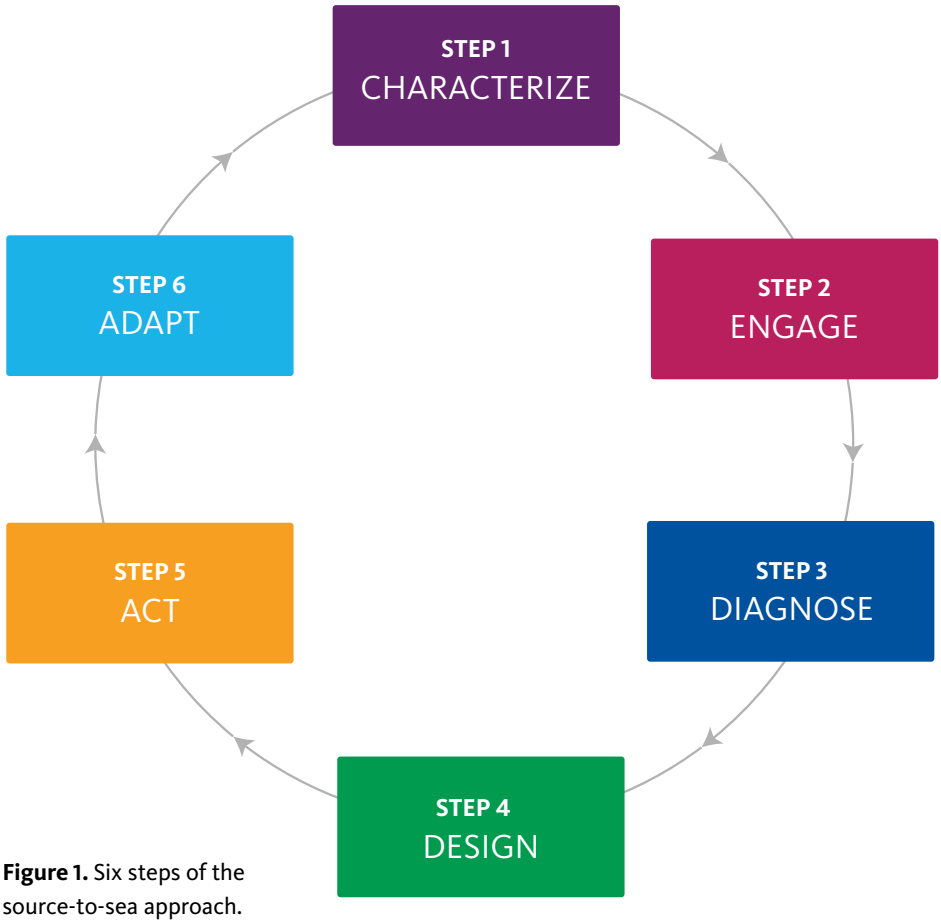


Figure 1. Six steps of the source-to-sea approach.

By following this guide, project and programme teams can integrate the source-to-sea approach in the design, planning and implementation of new or existing initiatives supporting holistic management, investments and stakeholder engagement by linking activities from source to sea.

The guide presents a general approach that can be used at all levels and can be adapted to the local context. The guide is intended to be a companion to existing project design, planning and implementation methods. It is expected that users of this guide already have an understanding of the project cycle and have access to adequate design, planning and implementation resources.

The conceptual framework used as the basis for the guide was first developed by the Action Platform for Source-to-Sea Management and the Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility (GEF) in 2016 and was presented and explained in a peer reviewed paper, Granit et al. 2017b, and was used for a STAP advisory document to the GEF, Granit et al. 2017a.

This practitioners' guide builds upon the source-to-sea concept in order to provide guidance for implementing the source-to-sea approach in projects and programmes and fills a gap in how to move from theory to practice by presenting a sequence of steps and guiding practices that will identify the changes needed to address the impacts of alterations in key source-to-sea flows.

How to use this guide

This guide intends to walk the reader through the six steps of the source-to-sea approach. Each step is clearly highlighted with its own colour and begins with a series of questions to help ready the reader for the concepts to be covered. Where possible, case studies have been introduced and a deliberate effort has been made to highlight key texts that we believe the reader may want to refer back to time and time again.

Introduction

The 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 (Figure 2). 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.

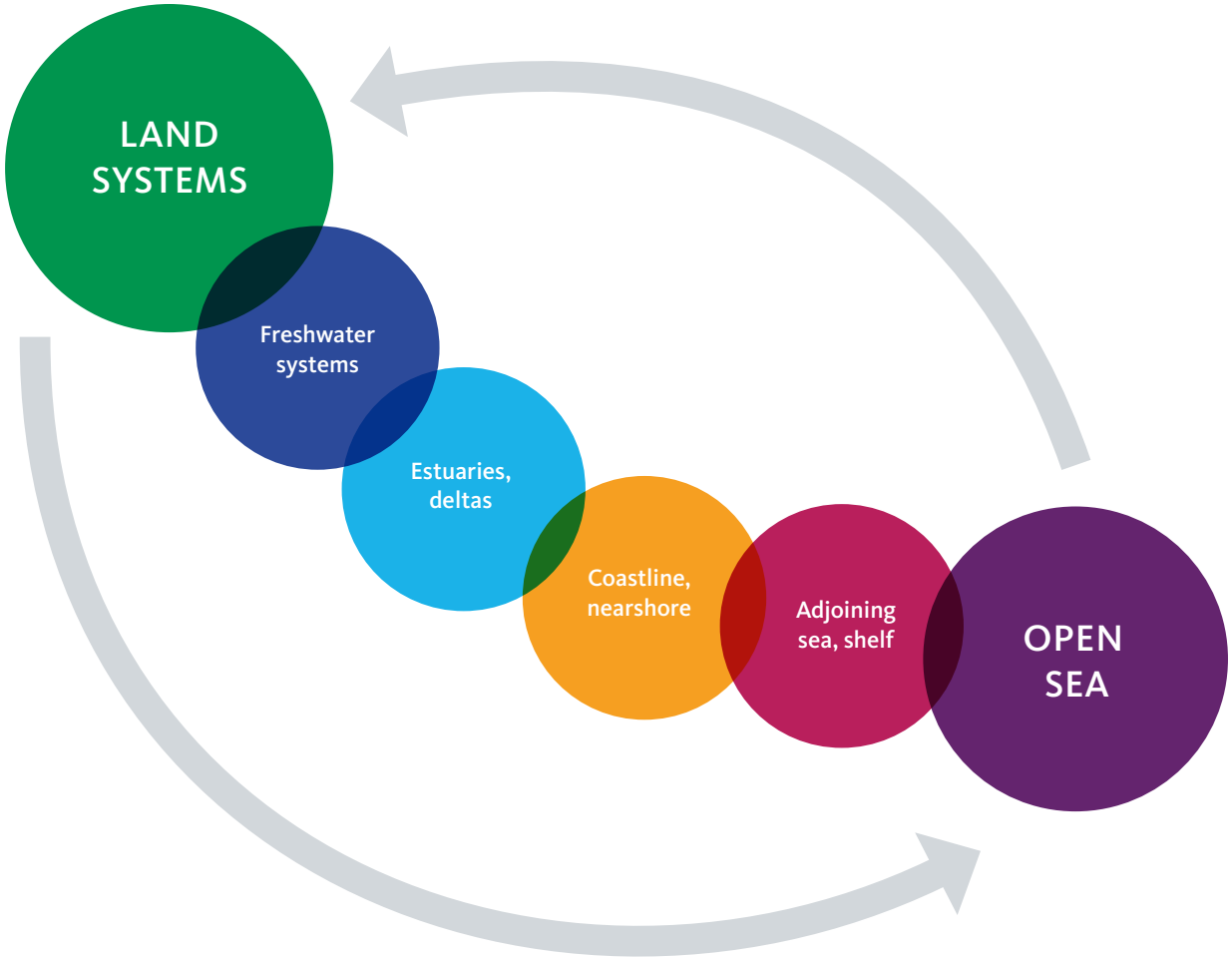


Figure 2. Segments comprising the source-to-sea system, arrows indicate the upstream-downstream linkages between the segments.

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.

Key source-to-sea flows

The source-to-sea concept identifies six key flows that connect the source-to-sea system from land systems to open oceans: water, sediment, pollutants, biota, materials and ecosystem services (Figure 3).

Figure 3. Source-to-sea key flows of water, biota, sediment, pollutants and materials combine to condition the ecosystem services that the source-to-sea system provides.

The source-to-sea approach

The source-to-sea approach directly addresses the linkages between land, water, delta, estuary, coast, nearshore and ocean ecosystems leading to holistic natural resources management and economic development. This approach provides a structured process to be undertaken in the design, planning, implementation and evaluation of 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, resulting in economic, social and environmental benefits.

The approach includes six steps (Figure 4), 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. This, in combination with selecting an appropriate scale of intervention, engagement of stakeholders (both upstream and downstream) and a thorough understanding of the governance context sets the basis for defining a theory of change to guide planning and implementation. Monitoring and adaptive management round out the process and can be used to refine the theory of change and ensure continuous improvement toward long-term outcomes.

Further explanation of each step in the source-to-sea approach is provided later in this guide, along with some practical examples. The steps can overlap, and iteration of steps may be required as more is learned about the source-to-sea system. Existing tools for water resources and ecosystem assessments, stakeholder participation and design of intervention strategies should be applied where they are useful to the completion of one or more of the steps. It is important to bear in mind that the scope of the analysis for Steps 2-6 is determined by the flow(s) and system boundary defined in Step 1. This is done purposefully to help to maintain a focused approach.

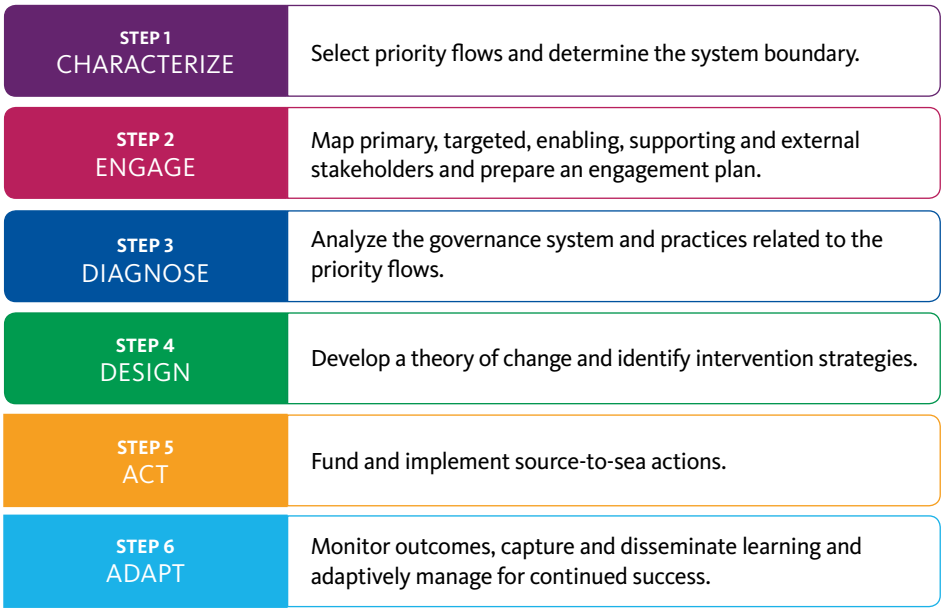
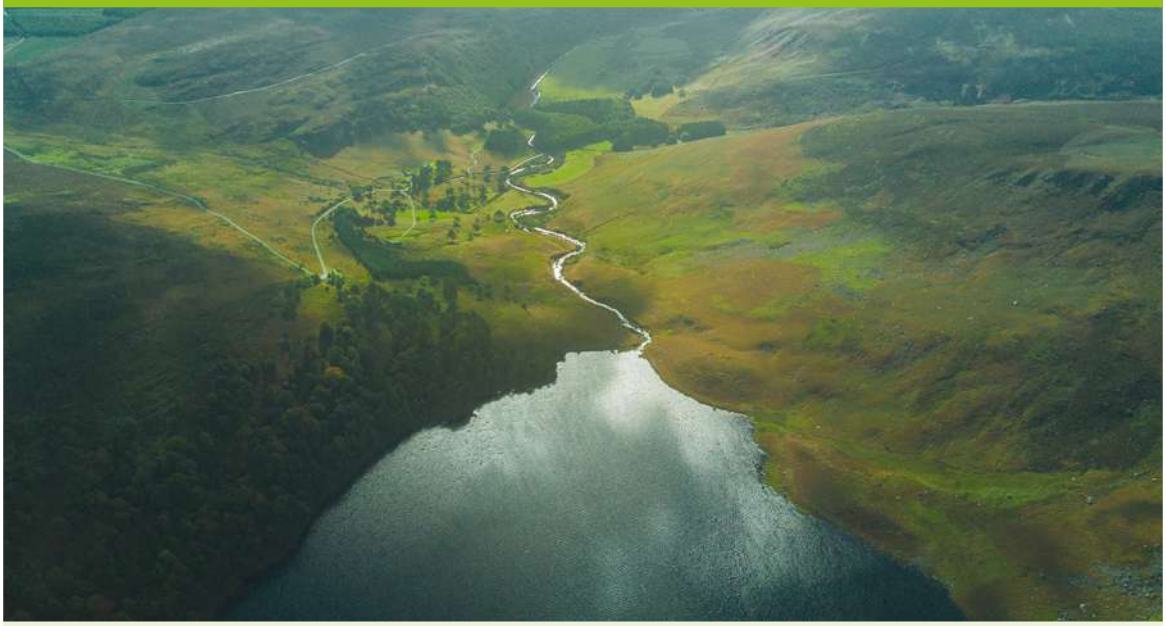


Figure 4. Six steps to implementing the source-to-sea approach.

KEY DEFINITIONS



SOURCE-TO-SEA SYSTEM | is the biophysical continuum of 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 nearshore 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. The source-to-sea system is linked by six key flows: water, biota, sediment, pollutants, materials and ecosystem services.

SOURCE-TO-SEA CONTINUUM | can be used when referring to the continuity of the source-to-sea system from land through to the ocean.

SOURCE-TO-SEA SEGMENTS | are the distinct components of the source-to-sea system: land systems, freshwater systems, deltas, estuaries, coastline, nearshore, adjoining sea, continental shelf and open ocean.

SOURCE-TO-SEA CONCEPT | refers to the conceptual framework that identifies six key flows that connect source-to-sea systems, elements to guide analysis and planning and a common framework for elaborating a theory of change to guide the design of future initiatives aimed at supporting green and blue growth in source-to-sea systems.

SOURCE-TO-SEA APPROACH | is a methodology for the operationalization of the source-to-sea concept into projects and programmes. It comprises six steps that the project or programme development team can employ to address various types of linkages across the source-to-sea system.

SOURCE-TO-SEA MANAGEMENT | is the intended outcome of applying the source-to-sea approach and refers to the establishment of governance, operations, practices and finance that increase collaboration and coherence across the source-to-sea system and reduce alteration of key flows (water, pollution, sediment, materials, biota, ecosystem services) resulting in measurable economic, social and environmental improvement across freshwater, coastal, nearshore and marine environments.

Impacts to be addressed with source-to-sea management

Unsustainable human activities on land, along aquatic systems and at sea are imposing a heavy burden on water-related ecosystems:

- Approximately 4–12 million tonnes of plastic enter the ocean from land-based sources every year passing through rivers and waterways.
- Nutrient loads from unmanaged agricultural runoff and inadequate wastewater treatment continue to cause eutrophication and spread of dead zones in our coastal and marine waters.
- Globally, over 80% of all wastewater is discharged without treatment, causing ecological damage, health risks and economic loss.
- Flows of some rivers are so highly diverted that little water reaches the sea, robbing coastal ecosystems of the water, sediment and nutrients they need.
- Fragmentation of rivers, from dams, weirs and other infrastructure has radically reduced anadromous and migrating fish populations worldwide.
- The degradation of freshwater, terrestrial and marine environments has a direct impact on crucial ecosystem services, livelihoods and food security, especially for the poorest people.

Why source-to-sea management?

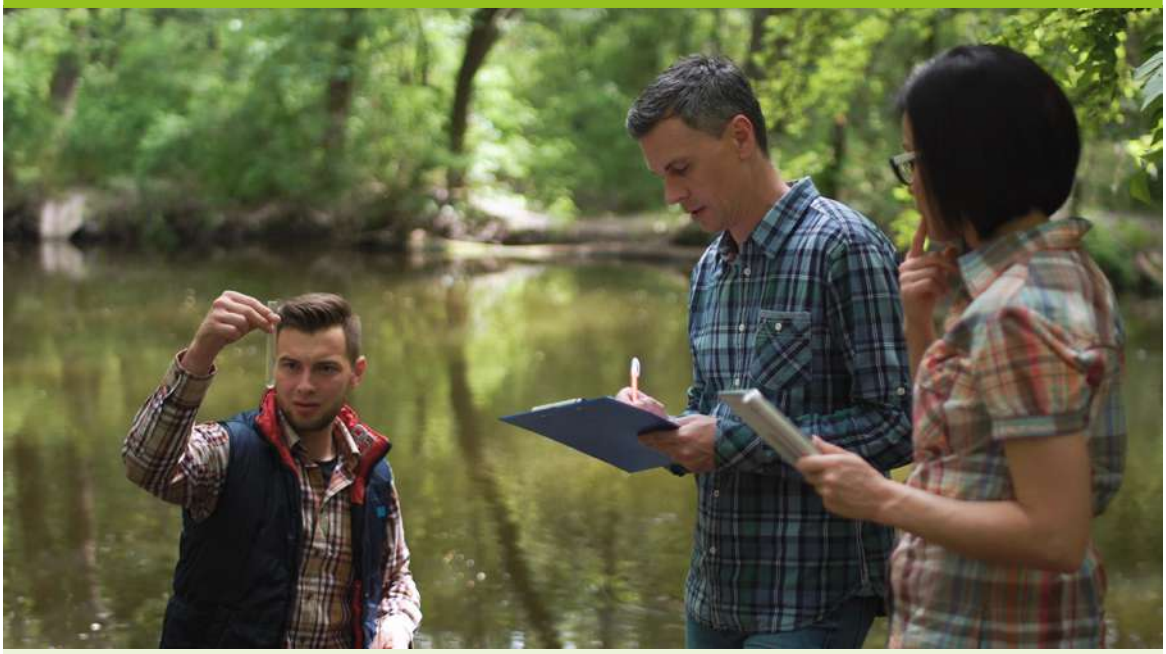
Source-to-sea management considers the entire source-to-sea system – stressing upstream and downstream environmental, social and economic linkages and stimulating coordination across sectors and segments.

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.

Traditional governance frameworks are often structured around individual segments of a source-to-sea system and/or focused on one sector, making them poorly suited tools for managing 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. Source-to-sea management can combat this by widening the perspective to include upstream and downstream linkages.

Experience with traditional water and river basin management tells us that it can take decades to fully understand and begin to address environmental degradation that is a result of activities that take place upstream or downstream of the impacts. While there is a need for a long-term commitment to coordinated and comprehensive source-to-sea governance arrangements that balance development objectives between different segments and sectors, source-to-sea initiatives also need to be able to respond to priority issues within project timeframes. This requires implementing targeted intervention strategies that address immediate issues while ultimately contributing to the functioning of the entire source-to-sea system in the longer term.

GUIDING PRACTICES



The source-to-sea approach expands on proven methods for project and programme development. The guiding practices below describe the foundations for the source-to-sea approach.

HOLISTIC | An essential characteristic of the source-to-sea approach is addressing upstream and downstream linkages across issues, stakeholders, desired outcomes, costs and benefits in designing the intervention strategies. When using a source-to-sea approach, the system boundary of the project or programme expands to include both upstream and downstream activities and impacts.

COLLABORATIVE | The source-to-sea approach is meant to build upon existing institutions, established methods and on-going processes by embedding source-to-sea thinking into what is already there.

PRIORITIZING | The source-to-sea approach prioritizes one or more flows pertinent to the aims of the project or programme. Prioritization empowers a manager to take quick action instead of conducting comprehensive and exhaustive assessment of all flows before implementing interventions. The move to a more complex and inclusive project or programme design should be driven by the learning that comes from implementing the project or programme.

PARTICIPATORY | Establishing the linkages between source-to-sea segments and across various sectors is fundamental to this approach. Participation of a range of stakeholders representing different segments and sectors needs to be secured, taking a bottom-up approach and expanding to include more stakeholders as needed to achieve the desired outcomes of the project or programme.

CONTEXT-DEPENDENT | The characteristics of the source-to-sea approach will be derived from, and responsive to, the local context. However, it must be ensured that local benefits are not gained through negative impacts elsewhere in the source-to-sea system.

RESULTS ORIENTED | The source-to-sea approach targets intermediate outcomes that contribute to overall improved economic, social and environmental status of the source-to-sea system.

ADAPTIVE | The source-to-sea approach relies on the principle of learning-by-doing through pragmatic implementation, monitoring, evaluation and adaptive management. This method allows early detection of progress or impediments in achieving desired outcomes and allows for effective course correction.

Source to sea on the global agenda

The SDGs and the 2030 Agenda

The 17 United Nations Sustainable Development Goals (SDGs), agreed to by the General Assembly in 2015, formulate an integrated and indivisible agenda and are intended to balance the social, economic and environmental dimensions of development. The benefits of source-to-sea management in linking across the SDGs, in particular, SDG 6: Ensure availability and sustainable management of water and sanitation for all and SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development have been highlighted at the United Nations Ocean Conference in 2017 and the High-Level Political Forum 2018.

The strength of the source-to-sea approach is its ability to hone in on priorities that span across the social, economic and environmental dimensions of the broader 2030 Agenda. The need for a source-to-sea approach has also been highlighted in funding strategies of the Global Environment Facility and Facility and Swedish International Development Cooperation Agency (Sida), in operational strategies of UN Environment, UNDP Water and Ocean Governance Programme and Swedish Agency for Marine and Water Management; and in ministerial declarations/outcome documents from World Water Forum and the 2018 Dushanbe High-Level Conference on SDG 6.

Source-to-sea linkages must be properly recognized and addressed as part of SDG implementation. Source-to-sea management can play an important role in ensuring that the linkages between the different goals, and their targets, are considered directly. Doing so will help balance upstream and downstream demands and make sure that investments to forward the achievement of one of the SDGs does not impede the achievement of others.

Climate change adaptation

Source-to-sea management has great potential for contributing to climate change adaptation. As sea levels rise, hydrologic regimes are altered and water chemistry shifts, the linkages between segments of the source-to-sea system become ever more evident and the need to address these changes from a broader perspective grows.

For example, the importance of maintaining sediment flows to deltas and coastlines must be looked at jointly with the benefits that upstream dams (material flow) provide in the form of energy, irrigation and flood control. By expanding the view from individual to multiple segments and from one to several sectors, source-to-sea management enables better understanding of the interrelationships across the source-to-sea continuum and opens up new partnerships between stakeholders for addressing social, economic and environmental impacts of climate change.

Step 1 Characterize

Select priority flows and determine the system boundary.

The first step of the source-to-sea approach is characterizing the key flows and prioritizing those you will work on. You need to select which key flows will be addressed and determine the system boundary of the project or programme.

GUIDING QUESTIONS

1 **What is known about the key flows and how they have been altered from their natural ranges of variation?**

2 **What are the sources of the alterations in the key flows and where do they occur?**

3 **What are the impacts from these alterations?**

4 **Given the key flows that have been altered, the origin of the alteration and their impacts, what is the system boundary?**

The key flows that connect the source-to-sea system are: water, sediment, biota, pollutants, materials and ecosystem services.

You choose your priority flows based on the character of these key flows in your source-to-sea system, the ways that they have been altered and the impacts of those alterations. By limiting the number of priority flows you get a more focused project or programme with targeted strategic interventions.

The selected priority flows, how they have been altered and the impacts of their alteration form the basis for determining the system boundary.

You choose your priority flows based on the character of these key flows in your source-to-sea system.

Understanding key flows

Key flows connect source-to-sea segments along the source-to-sea continuum at different spatial scales. These key flows in large part define the attributes of the source-to-sea system and their characteristics determine the health of the segments and the system. All flows have natural ranges of variation that biodiversity and human activities have adapted to. Variation outside of these natural ranges can disrupt individual species' life cycles, impact human health, alter ecosystems and disrupt social and economic systems.

The key flows of water, sediment, biota and ecosystem services occur in natural systems and are altered by human activities. The flows of pollutants and materials are inputs to the natural system from human activities and cause alterations in water chemistry (quality) and geomorphology.

Ecosystem services supplied by the source-to-sea system are directly impacted by the alteration of water, sediment and biota flows and the introduction of pollutants and materials.

KEY FLOWS WITHIN THE SOURCE-TO-SEA SYSTEM

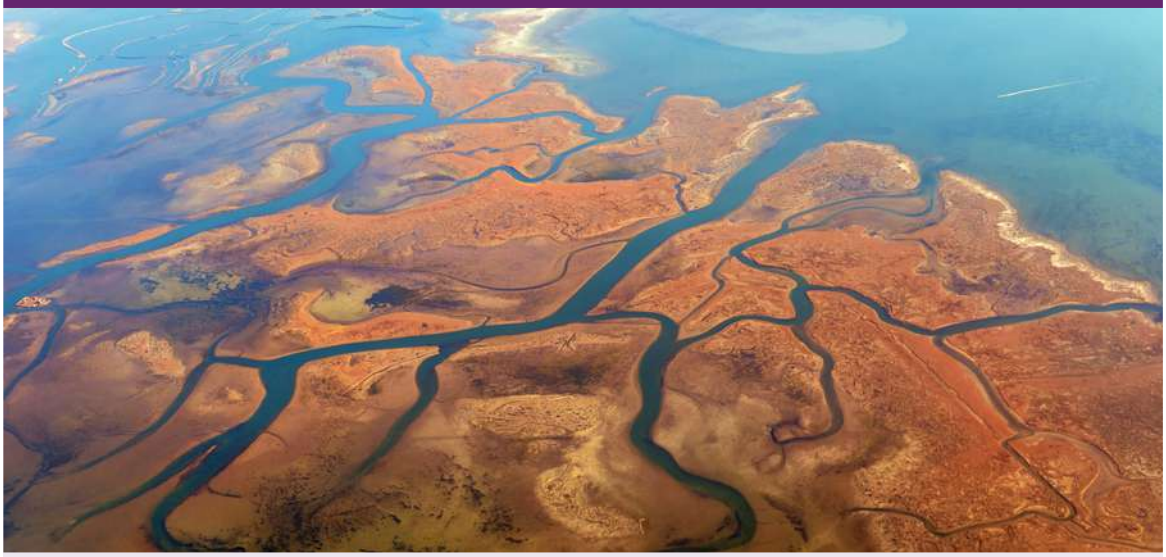


Photo: Pavliha | iStock

WATER | Water flows and their intra- and inter-annual patterns strongly define the attributes of river, floodplain, delta, estuarine, coastal and nearshore ecosystems. Alterations to water flow regimes can occur through various activities, such as water withdrawals, dam operations, land uses, channelization and climate change.

SEDIMENT | Sediments of different sizes build river beds, beaches, floodplains and deltas. Sediment flows can increase or change in type through land-based activities. Activities that cause soil degradation and erosion can increase sediment flows, while sand and gravel mining and dams can reduce sediment flows.

BIOTA | Biota refers to the plant and animal life that may be living within a source-to-sea system. Terrestrial, freshwater, estuarine, and marine biota have adapted over millennia to the available habitat conditions and over their life histories may utilize a range of habitats. Dams and other impediments to movement between habitats risk disrupting these biota flows by reducing connectivity within the source-to-sea system. Habitat loss and degradation, changes in water quantity and quality, overharvesting in one or more segments of the source-to-sea system can also disrupt biota flows.

POLLUTANTS | The physical and chemical properties such as temperature, pH, salinity, nutrients, inorganic chemicals, pathogens and suspended solids help define freshwater and marine ecosystems. A range of pollutants can enter source-to-sea systems from a variety of sources, e.g., industrial and domestic wastewater, agriculture, horticulture and silviculture, aquaculture, etc., and can be transported through the source-to-sea system altering ecosystems and impacting human health.

MATERIALS | The geomorphology of river, delta and coastal systems defines the habitats that are available for riparian, aquatic, estuarine and marine species. Human-built infrastructure such as dams, bridges, culverts, dikes, levees, etc., clearing and hardening of shorelines, draining of wetlands and land reclamation can alter the geomorphology of source-to-sea systems. These material flows can disrupt positive flows of water, sediments and biota by either blocking them entirely or altering their movement and can alter or disconnect vital habitats.

ECOSYSTEM SERVICES | Ecosystem services are the ecosystem conditions or processes utilized, actively or passively, to contribute to enhanced human well-being including (i) provisioning services such as ensuring water supply for different uses; (ii) water regulating services e.g., control of climate and disease; (iii) cultural services such as spiritual and religious values; and (iv) support services, for example, providing a habitat for ecosystems, nutrient dispersal and recycling. Alterations in the flows above may result in the reduction in the availability of ecosystem services.

CASE STUDY | BAY OF BENGAL

Identification of priority flows

A woman is carrying seafood on her head walking on the beach of Cox's Bazar, Bangladesh Photo: Tarzan980 | iStock

The Bay of Bengal Large Marine Ecosystem (BOBLME) is one of the world's largest marine ecosystems and covers 6.2 million km^2. Marine litter, pollution and sewage-borne pathogens are causes for concern and are now being tackled through a source-to-sea approach.

About 66 per cent of the BOBLME lies within the exclusive economic zones of BOBLME countries – Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, and Thailand – the remainder being high seas. To create enabling conditions for ecosystem-based management, including management of some key source-to-sea flows, the project team used a transboundary diagnostic analysis (TDA).

The priority source-to-sea flows identified in the BOBLME include flows of sediments, pollutants and marine litter from some of the world's largest river systems, as these are critical pressures on the Bay of Bengal.

The Ganges-Brahmaputra-Meghna catchment – a significant tributary to the BOBLME – is one of the top ten ranked catchments in terms of plastic loads to oceans globally. A source-to-sea intervention in some interlinked segments of this system could reduce marine litter not only in the Bay of Bengal, but also in the high seas, demonstrating the global linkages of this source-to-sea system.

In addition to marine litter, the pollutants of concern in the BOBLME are sewage-borne pathogens, organic load from sewage and other sources, nutrient pollution, oil pollution, persistent organic pollutants (POPs), persistent toxic substances, and mercury pollution.

The drivers of pollutant discharge to the Bay of Bengal are the widespread emissions of untreated or inadequately treated domestic, industrial and agricultural wastewater; inadequate solid waste management, including widespread discharge of solid waste into water bodies and the open burning of solid waste generating dioxins and furans; increasing emissions of nutrients from fertilizer use in agriculture and expanding aquaculture; atmospheric emissions from industry and fossil fuel burning; and routine operational discharges of oil from shipping and dumping of waste oil by vessels and vehicles on land.

The Food and Agriculture Organisation (FAO) and the Asian Development Bank (ADB) have embarked on a joint response to address the pollutant flows. FAO is focusing their interventions initially on fishing ports where dissemination of improved waste management practices will contribute to improved waste disposal and public health. ADB is supporting the city of Mandalay to address pollutant flows in catchments draining into sensitive coastal environments and flows of waste in river basins that ultimately reach the open ocean by investing in eco-waste solutions. These interventions are expected to lead to improved environmental status in the BOBLME in the long term.

Priority flows of pollutants and marine litter have indicated that the system boundary needs to be expanded to include land-based sources such as fishing harbours and the city of Mandalay, which are primary sources of these flows. ●

Characterizing key flows

In many systems there is already knowledge of key source-to-sea flows, their alterations and impacts, in which case this information can be used to determine the system boundary and quickly move to next steps in the source-to-sea approach. When absent, rapid assessment of key flows based on existing data and studies and participatory appraisals involving stakeholders can be the basis for selecting the priority flows.

It is important to keep in mind that the source-to-sea approach is pragmatic and adaptive, i.e., it is not necessary to have perfect knowledge of the flows and their alterations to advance through the steps. Instead, projects and programmes can be developed using best available knowledge and integrate monitoring and evaluation that builds upon the initial learnings.

Altering key flows

Different human activities can alter the key flows. These alterations can cause impacts upstream and/or downstream of the activities that are altering the flows and can have social, economic and/or environmental consequences at local, regional or global scales. A few examples of alterations of key flows are decreased dry season flows due to irrigation withdrawals, sediment starvation in deltas resulting from sand and gravel mining, reduced fish populations caused by overfishing of commercial species or increased nitrogen levels and eutrophication from poor or no wastewater treatment.

Climate changes can also alter some aspects of the key flows and these alterations need to be considered for realistic forward planning. Climate change induced alterations in the key flows can range widely and will depend upon the unique characteristics of the source-to-sea system and the selected priority flows.

For example, hydrologic patterns may alter due to changes in precipitation; sediment loads may increase due to higher intensity rains; water temperatures may rise making habitats unsuitable for some aquatic species; increased flood defence infrastructure may reduce or cut off the exchange of fresh and salt water in estuaries. The project or programme development team will need to assess both the near-term and longer-term impacts of climate change on the key flows to ensure that intervention strategies result in greater resilience across the source-to-sea system.

The socio-economic characteristics of the source-to-sea system will influence the selection of priority flows, e.g., in source-to-sea segments dominated by agriculture, the focus may be on reducing nutrients, pesticides and sediments resulting from agricultural activities and increasing water efficiency to reduce withdrawal volumes. Conversely, in more urban environments the focus may be on reducing plastic waste, wastewater treatment and installing green infrastructure for nature-based flood management.

Selecting priority flows

The priority flows can also be narrowly defined. The following are some examples of how the project or programme can focus on one aspect of the priority flows.

- Decreased water flows due to increasing withdrawals from growing urban areas.
- Increased sediment flows due to soil erosion from agricultural areas.
- Reduced biota flows due to blocked migration of anadromous fish populations.
- Increased pollutant flows due to plastic leakage from land-based sources.
- Material flows (levees) cutting off floodplains from the main channel resulting in loss of aquifer recharge.
- Loss of ecosystem services (water purification) and poorer water quality from draining wetlands.

Determining the system boundary

Understanding the drivers, pressures and impacts of the alteration of flows and where along the source-to-sea continuum these activities occur is essential for determining the system boundary for the project or programme. The system boundary is defined by:

- the priority flows that have been selected;
- the characteristics of the alterations to priority flows;
- the impacts arising from alterations in priority flows and their location;
- the activities contributing to the alterations in priority flows; and
- the geographic scale of the strategic interventions.

The appropriate system boundary could vary from one or more closely connected segments, to a river basin and downstream recipient water body, a sea and its drainage area, or even global system linkages, e.g., in relation to climate change or marine litter.

In the example of the Bay of Bengal Large Marine Ecosystem (BOBLME), the Bay of Bengal is the geographic focus of the project and the priority flows of pollutants, marine litter and sediment result in a system boundary that includes fishing harbours and the city of Mandalay. Interventions at the fishing harbours and in the city of Mandalay are directed toward addressing pollutants entering the Bay of Bengal from these sources. The system boundary may expand as other sources of pollution are identified as strategic to address and as the project tackles sediment and marine litter.

Connecting the steps

The characterization of key flows and the selection of the system boundary are used in Step 2 to identify the stakeholders to involve in the project or programme and in Step 3 when identifying governance and practices related to the priority flows.

Step 1 Output

The output of Step 1 is an assessment document of key flows in the source-to-sea system including:

1. Degree and type of alteration from natural regimes for key flows and selection of priority flows to be addressed;
2. Identification of activities that alter priority flows;
3. Locations of activities resulting in alteration of priority flows;
4. Environmental, economic and/or social impacts of alteration in priority flows;
5. Stakeholders impacted by the alteration of priority flows and how;
6. Locations of impacts from the alteration of priority flows;
7. Delineation of the system boundary for the project or programme.

Step 2 Engage

Map primary, targeted, enabling, supporting and external stakeholders and prepare an engagement plan.

Step 2 in the source-to-sea approach is all about engaging with others and building partnerships. To do that, you need to identify who your main stakeholders are and create a plan for your engagement with them.

GUIDING QUESTIONS

1. **Which individuals or groups are affected by the alteration of priority flows and will directly benefit from project/programme interventions? These actors are known as primary stakeholders.**

2. **Which individuals or groups are contributing to the alteration of priority flows and whose practices must be directly targeted to reduce alterations of flows? These actors are known as targeted stakeholders.**

3. **Which institutions provide or should provide enabling conditions for behavioural changes and benefits to occur and be sustained over time? These actors are known as enabling stakeholders.**

4. **Are there development partners or financiers whose strategies are aligned with the outcomes of the project or programme? These actors are known as supporting stakeholders.**

5. **Are there individuals or groups outside the system boundary who share an interest in the outcomes of the project? These actors are known as external stakeholders.**

Designing a course of action for addressing alterations to the priority flows and their impacts requires a thorough understanding of the stakeholders within the system boundary. Stakeholders to be considered should also include those who have an interest in, could be financiers of or contribute solutions to the project or programme activities and/or results. Stakeholders might be defined by economic sectors (such as agriculture and industry), social or environmental interests, and cultural or indigenous groups that rely on the generated ecosystem goods and services.

By bringing together stakeholders from across the source-to-sea system, new insights, opportunities and solutions may arise.

When using a source-to-sea approach, the range of individuals, groups and institutions that are included in the stakeholder analysis and engagement plan may include groups not previously considered. For example, an ocean-focused project looking at marine pollution may initially work on ocean clean-up and abandoned fishing gear. By taking a source-to-sea approach to the problem of marine pollution, the project looks upstream to land-based pollution and the delivery of these pollutants via waterways.

In Step 1, the selection of priority flows and the system boundary will have already accounted for the linkages across the source-to-sea system. Step 2 builds on this through conducting a stakeholder assessment that identifies those individuals, groups and institutions related to the source-to-sea segments within the system boundary and the priority flows.

SOURCE-TO-SEA STAKEHOLDER GROUPS

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.

The identification of stakeholders further explores source-to-sea linkages by mapping the individuals, groups and institutions and their relationships to the priority flows, their alteration and the source-to-sea segments within the system boundary. It should be noted that you may need to revise who your stakeholders are, if new priority flows are selected due to the impacts of climate change.

Stakeholder groups

Primary stakeholders

Primary stakeholders are those individuals or groups that are being negatively impacted by the alteration of key flows. They might be located near the activities that are altering the priority flows or they may be located upstream or downstream of these activities. For example, in the case of a dam interfering with fish migration, the primary stakeholders might be both the downstream local river fishers who have reduced catch due to decreasing fish populations as well as the tour boat companies that lose business because the sightings of large marine mammals have decreased due to the reduction in an important feed stock.

Targeted stakeholders

Targeted stakeholders are those whose activities are responsible for the alterations in the priority flows. These are the stakeholders whose practices the project or programme is focused on changing. Special attention needs to be paid to producers using natural resources e.g., farmers, forest managers, aquaculture farmers, etc as well as public and industrial sectors whose activities may influence the priority flows.

Changing the behaviour and practices used by targeted stakeholders is the focus of a source-to-sea project or programme.

Engaging these stakeholders is strategic because this is where decisions take place that affect the resource use and result in alterations in the source-to-sea flows. Depending on the number of targeted stakeholders, it may not be feasible to assess each targeted stakeholder's contribution to the alteration of flows (e.g., the case of smallholder farmers); initial analysis may therefore focus on 'production patterns' used broadly by the targeted stakeholders, such as the type of farming practices generally used in the area.

Identifying the targeted stakeholders is an important input into Steps 4 and 5 – developing the theory of change, designing the intervention strategies and implementing the project or programme. It should be noted that as practices undertaken by the targeted stakeholders change, there may be some stakeholders who have benefitted from the status quo who will now be impacted by these changes. Identifying these stakeholders and ensuring an equitable sharing of the costs and benefits of moving toward a more sustainable source-to-sea system will need to be included in the design of intervention strategies in Step 5.

The system boundary is helpful in identifying the targeted stakeholders central to the project or programme. For example, in the case of climate changes altering priority flows, while this is a global problem to which everyone contributes in a greater or lesser degree, the system boundary may limit the targeted stakeholders to local stakeholders who can help build adaptive, resilient governance mechanisms and resource use.

Enabling stakeholders

Enabling stakeholders are the institutions (e.g., ministries of agriculture, environment, industry or infrastructure, municipal governments, water user associations, sustainability certification systems) whose mandates partially or totally overlap the activities causing alterations to priority flows as well as those who have responsibility for managing those flows.

Enabling stakeholders are engaged to create the supportive conditions for targeted stakeholders to alter their behaviour and improve their practices.

Depending on the system boundary, enabling stakeholders might include institutions with mandates applicable to one or more segments of the source-to-sea system and may be actors at the local, national, regional or global scale.

These stakeholders are central to providing the enabling conditions that will support the changes in practices that will reduce the alteration of priority source-to-sea flows and alleviate the impacts felt by the primary stakeholders. The enabling stakeholders may receive benefits from the project or programme, e.g., financing, capacity building or technical assistance. Identifying

these stakeholders is an important input for evaluating the governance system in Step 3.

In considering climate changes, enabling stakeholders may need to include those parties that can support direct investment toward mitigation of climate change or support adaptation that increases social, economic and environmental resilience.

Supporting stakeholders

Supporting stakeholders may not have a direct role within the system boundary but may be important stakeholders to coordinate, cooperate or communicate with and/or may provide financial support to the project or programme. These stakeholders' development or investment strategies likely align with the desired outcomes of the project or programme and may be leveraged for project or programme success.

For example, the Global Environment Facility Transboundary Waters programme can support source-to-sea projects and climate change funding (e.g., Green Climate Fund) can be a source for funding source-to-sea projects or programmes that incorporate activities to build climate change resilience.

Supporting stakeholders' interests may include several source-to-sea segments, thereby reinforcing the linkages across the source-to-sea continuum or involvement in the project may expose them to a broader perspective. Identifying these stakeholders is an important input to Steps 5 and 6 – funding the project or programme and disseminating and communicating results.

External stakeholders

External stakeholders are outside the system boundary but may share interests with the desired outcomes of the project or programme.

External stakeholders can help strengthen commitment to source-to-sea management.

Following the example above, the external stakeholders may include households who pay higher prices for fish due to decreased supply, environmental organizations concerned about fish populations or sector organizations advocating for sustainable fisheries. These external stakeholders may have limited participation in the implementation of the project or programme but may provide political will or market forces supporting the intended behaviour changes in the targeted stakeholders.

External stakeholders can also be organizations that promote source-to-sea management in the global agenda, e.g., in achieving the Sustainable Development Goals or as a tool for increasing climate change resilience.

The theory of change developed in Step 4 may define a role for the external stakeholders in contributing to the changes needed, as well as dissemination and communication functions in Step 6.

CASE STUDY | MARINE LITTER

Engaging stakeholders for marine litter prevention

Given the nature of the marine litter problem, i.e. that plastic found in oceans to a large extent arises from activities on land and is transported by waterways, source-to-sea management can play a key role in addressing this issue and can engage stakeholders at local, national and global levels.

Designing a course of action for preventing marine litter and its impacts requires a thorough understanding of the full set of stakeholders across three scales – local, regional and global – and their interests and motivations for contributing to reducing plastic leakage. In the case of plastic leakage from land-based sources, the following categories of stakeholders will need to be engaged.

Primary stakeholders who are negatively impacted by plastic leakage and will benefit from intervention strategies preventing it.

Targeted stakeholders whose practices are contributing to the amount of plastic leakage to riverine and marine environments and whose behaviour change is directly targeted. Enabling stakeholders that provide the conditions for behaviour changes that result in preventing plastic leakage and for these to be sustained over time.

Supporting stakeholders such as development partners or financiers whose strategies are aligned with reduced plastic leakage. External stakeholders such as individuals or groups outside the system boundary who share an interest in reduced plastic leakage.

Coordination between stakeholders from source to sea can support prioritization of investment and implementation of intervention strategies, directing resources to solving issues at the local, regional and national scales where funding, capacity and infrastructure is insufficient to the task of marine litter prevention. ●

Source: Mathews and Stretz, (in review)

Stakeholder engagement

Understanding the social and sectoral dynamics, the various positions and interests at stake and the power relations among stakeholders forms the basis for the stakeholder engagement plan. To ensure strong engagement from all stakeholders, it is important to identify what the different stakeholder groups stand to benefit or lose from their engagement and what the incentives are that would ensure their participation.

Engaging stakeholders from source-to-sea can result in improved environmental quality for citizens, health benefits, increased cost effectiveness for certain measures or greater economic potential for downstream sectors such as coastal tourism or fisheries. There may be reputational gains for a sector or municipality or better decisions through inclusive representation of marginalized people.

In formulating the stakeholder engagement plan, the aims of the engagement and the modalities used will need to be tailored to the specific stakeholders and the context within which the project or programme is operating. In some projects, stakeholder groups will be engaged individually, while in others, stakeholder groups will be brought together.

For targeted stakeholders, the overarching aim will be to change the practices employed that result in the alteration of the priority flows. For example, for reducing the amount of packaging waste entering the ocean, the targeted stakeholders may include the general population who uses packaged goods, the municipal solid waste management entities, informal waste pickers and corporations selling packaged goods.

The modalities of engagement for targeted stakeholders may range from awareness raising, to training and capacity building, to establishing sector roundtables for developing shared precompetitive agreements. Whereas with enabling stakeholders, the aim may be to strengthen an individual institution, establish new laws, policies and regulations or it may be to enhance inter-institutional coordination. The modalities for each of these aims will be quite different. Supporting and external stakeholders may be engaged to facilitate or contribute to the engagement of targeted and/or enabling stakeholders.

Connecting the steps

What is learned about the stakeholders will be very important in the following steps. For example, the knowledge about the primary stakeholders will be used in designing the monitoring plan and reporting results in Step 6. The information collected on the targeted and enabling stakeholders will be applied to diagnosing the governance system and practices in Step 3 and developing the intervention strategies in Step 4.

For financing activities in Step 5, you need to know who the supporting stakeholders are and identifying the external stakeholders will be useful in building political will for implementing intervention strategies in Step 5 and for disseminating results in Step 6.

Step 2 Output

The output from Step 2 is:

1. Stakeholder mapping that identifies the primary, targeted and enabling stakeholders to be directly engaged in the source-to-sea project or programme, and the supporting and external stakeholders with an interest in the issue being addressed.
2. A stakeholder engagement plan.

Step 3 Diagnose

Analyze the governance system and practices related to the priority flows.

The success of your source-to-sea implementation is not only up to you, but also depends on establishing the enabling conditions that will support the use of practices that help you reach your project or programme goal. In Step 3, you need to analyze the gaps in the existing governance system and the practices that are impacting the priority flows.

Luanda, Angola: entrance to the Ministry of Fisheries and the Sea. **Photo: mtcurado | iStock**

GUIDING QUESTIONS

1. **Which institutions, legal and regulatory frameworks, rights, ownership, informal agreements have management mandates for priority flows, targeted activities and/or source-to-sea segments?**
2. **Are those management mandates in conflict with each other and are they supportive of achieving the desired source-to-sea outcomes?**
3. **Are there other actors, e.g., companies or non-governmental organizations, that may influence the priority flows, targeted activities and/or source-to-sea segments?**
4. **What is the relative power and impact of government, the private sector and civil society in affecting the condition of the source-to-sea system?**
5. **Are the practices being used by the targeted stakeholders in line with the institutional mandates or is there a failure in enforcement?**
6. **Are there mechanisms for stakeholders to be involved in decision making, are there procedures in place for resolving conflicts that may arise between stakeholders and are they being effectively applied?**

Governance baseline

The analysis of the governance system and practices should be focused on identifying what is leading to the problem you are trying to address. This can lead to an understanding of the context within which priority flows are being altered and the underlying reasons why specific practices are being used. The aim is not to conduct a thorough assessment of the governance system but should be targeted towards understanding what has led to current practices with the goal of quickly identifying the specific pathways that will allow change to occur.

Identifying governance gaps illuminates the path toward source-to-sea management.

This governance baseline will provide a narrative that can be used to build a common understanding of the strengths and weaknesses of the current situation and can lead to identifying what changes are needed to reach the goals of the project or programme.

The analysis is the starting point for identifying the changes needed within a governance system and can reveal where mandates and practices are not adequately addressing the linkages between source-to-sea segments.

In the analysis of the governance system (Figure 5), consider institutions with mandates related to land use (urban, rural, coastal), freshwater management (surface and groundwater; quantity and quality), natural resource use (agriculture, horticulture, silviculture, mining, fisheries), environmental protection (including protected areas in terrestrial, freshwater and marine environments), development policies (e.g., economic, energy, transportation) and the policies, procedures and regulations within and across segments of the source-to-sea continuum. These can be local, national, regional or global institutions and agreements as well as community level user groups or resource management agreements.

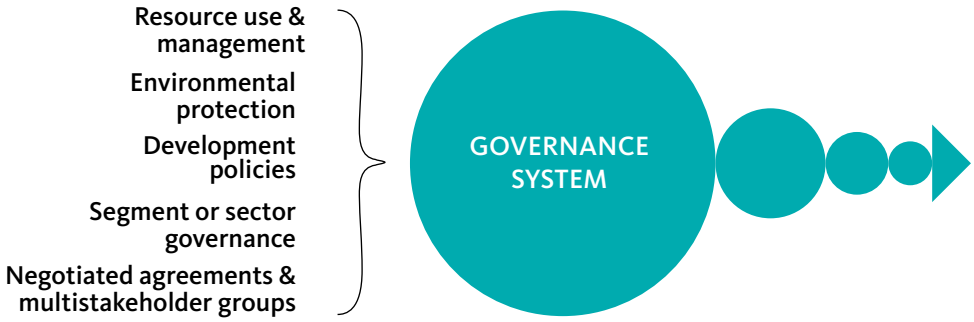


Figure 5. Governance system for source-to-sea approach.

The governance baseline will diagnose where governance is weak or not sufficiently taking into account source-to-sea linkages. As indicated in Annex 1, different forms of integrated management have been developed to address subsections of the source-to-sea system, however these may not be coordinated across the full source-to-sea continuum. Planning at the local and national levels has also often focused on individual or adjacent segments of the source-to-sea system leading to poor coordination between management frameworks (Figure 6).

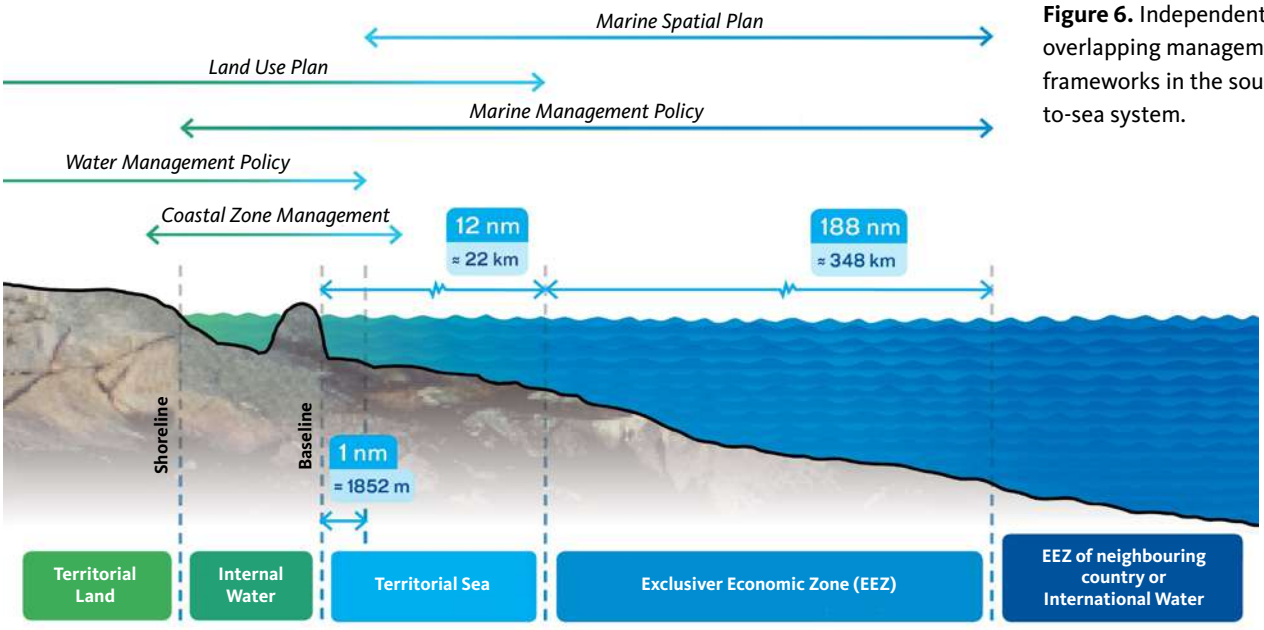


Figure 6. Independent and overlapping management frameworks in the source-to-sea system.

Overlapping spatial plans over land and sea in Sweden from Swedish Agency for Marine and Water Management.

Crews respond to Deepwater Horizon oil spill. Photo: J Henry Fair/Marine Photobank

How to analyse the governance system

- Identify any policies, procedures and regulations that have conflicting aims or transfer impacts from activities in one segment to another segment of the source-to-sea system.
- Evaluate whether institutions with different mandates along the source-to-sea continuum are collaborating effectively to achieve common goals and objectives or if they are conflicting with each other.
- Determine if any policies, procedures or regulations support source-to-sea management. Are these being enforced?

Improving coordination across segments is one of the main outcomes of source-to-sea management. In 2011, Sweden formed an integrated freshwater and marine agency, Swedish Agency for Marine and Water Management (SwAM) to better enable this cross-segment coordination.

It is important to go beyond governmental institutions and to also assess other actors that can influence the practices being used. Other actors to be looked at might include the private sector, international standards systems, knowledge institutes, non-governmental organizations and civil society groups. In some cases, these organizations supplement, or fill gaps, in formal governance systems. Ongoing sectoral or multi-stakeholder processes should also be identified as these may provide opportunities to introduce the source-to-sea approach to existing projects, programmes and/or dialogues, avoiding replicative and competing efforts.

CASE STUDY | SWEDISH AGENCY FOR MARINE AND WATER MANAGEMENT

Integrating marine and freshwater management for source-to-sea benefits

In 2011, Sweden formed a new government agency organized around the source-to-sea principle. The result has been a more holistic approach to environmental problems.

Recognition that water flows through a coherent terrestrial-coastal-marine system led to the establishment of the Swedish Agency for Marine and Water Management (SwAM). The agency began its operations in 2011 after merging the main parts of the Swedish Board of Fisheries, which then closed, and parts of the Swedish Environmental Protection Agency. The result was a unique government agency responsible for implementing EU and national policy and regulatory frameworks addressing freshwater, marine and fisheries management.

Gathering the main responsibilities for marine and water management under one roof encourages government, authorities and society to take a more holistic view of environmental problems and challenges in the source-to-sea continuum. Factors including changes to national policy, climate change and meeting international targets are driving the need for coordinated management from source to sea. Below are four developments illustrating the growing demand for more holistic management.

- Sweden has set a target of a 100 per cent renewable electricity system by 2040, relying significantly on hydropower. The country has also introduced new legislation that recognizes the need to make hydropower sustainable from an environmental perspective, launching a 20-year national programme to ensure that all hydropower plants have modern environmental permits and can support the national energy targets.
- National and EU policy promoting a blue economy has pushed for a new Marine Spatial Planning (MSP) framework by 2021.

The MSP addresses key development areas such as renewable energy at sea, defence, navigation, fisheries, seabed mining and marine protected areas.

- Climate change has resulted in water scarcity in the southern parts of the country during summer months leading to freshwater rationing for households, industry and agriculture and having devastating impacts on freshwater ecosystems through increased water temperature and dwindling water resources.
- The current state of water quality in general in the Swedish fresh and marine systems is far from reaching both EU and Swedish targets of good ecological status.

After a few years of operation, SwAM still faces challenges; particularly in relation to achieving coordinated management of activities from source to sea within the agency itself and externally between national and county board agencies. The planning frameworks are not fully adapted for management from source to sea and the physical boundaries of catchment and marine management do not fit the current political and economic arrangements at the national level. Complexities of overlapping jurisdiction, boundaries and mandate have been highlighted in Figure 6.

However, despite challenges, momentum is growing around the source-to-sea approach and dialogue between stakeholders to meet environmental as well as social and economic objectives is increasing. ●

Source: J. Granit, Swedish Agency for Marine and Water Management (personal communication)

Practices

Practices that influence source-to-sea key flows can include how a smallholder farmer plants, fertilizes, waters, etc. his/her crops; a municipality's wastewater management; dam operations and removal of mangroves from shorelines.

Internationally accepted practices such as integrated water resources management (IWRM), sustainable forest management (SFM), integrated coastal management (ICM) or marine spatial planning (MSP) may be useful in achieving the aims of the source-to-sea project or programme (Annex 1). These practices include a range of complementary measures that are adapted to the biophysical and socioeconomic context for the protection, conservation and sustainable use of resources and their ecosystem functions. They help decision makers adopt appropriate options for the use of natural resources based on their natural potential, hence avoiding unsustainable exploitation and further degradation. Similarly, sector specific and general best practice standards and certification programmes may be a reference point when engaging private sector stakeholders.

The source-to-sea approach may lead to integrating these different practices to address the linkages across the source-to-sea continuum. This could be facilitated by the fact that they have as a common guiding principle – the elaboration and implementation of coherent and comprehensive sustainable development solutions. The combined use of these integrated planning approaches should provide compatible solutions from different segments throughout the source-to-sea continuum.

The extent that the governance system enhances climate change resilience and is adaptive in responding to climate changes should be evaluated where relevant to the project or programme. The governance analysis will also point to the changes needed to support the use of practices that provide benefits across the source-to-sea continuum.

Connecting the steps

The analysis of the governance system and practices related to the priority flows will feed into the definition of the theory of change and identification of strategic interventions in Step 4.

Step 3 Output

The output from Step 3 is:

1. Governance baseline analysis with relevance to priority flows, sectors related to targeted stakeholders and impacts to primary stakeholders and source-to-sea segments.
2. Assessment of overlaps and gaps in governance and management frameworks and identification where coordination is needed.
3. Baseline analysis of current practices and gap assessment of enabling conditions for improved governance practices.
4. Identification of existing engagement processes that can be joined or built upon.

Photo: Local fisherman mending his fishing net after a fishing trip in Goderich fishing community, Sierra Leone. **Photo: Sub Regional Fisheries Commission**

Step 4 Design

Develop of a theory of change and determine intervention strategies.

At Step 4, you're ready to design the project or programme so that it will have the desired impact. For this, you need to formulate your theory of change, to articulate your goals and the activities that will take you there.

GUIDING QUESTIONS

1. **What is the long-term impact that the project or programme is aiming for?**
2. **What social, environmental and/or economic benefits will be reaped by the primary stakeholders and to what extent will resilience be increased as a result of the project or programme?**
3. **What practices are to be used by the targeted stakeholders to achieve the long-term impact of the project or programme?**
4. **To what degree are enabling conditions present for the desired changes in practices to occur and sustain over time?**
5. **What activities and intervention strategies will change the practices of the targeted stakeholders and establish the necessary enabling conditions?**
6. **If the desired practices are implemented, how will priority flows and the status of the source-to-sea system be changed?**

A well-developed theory of change, or results chain, is the basis for strong project or programme design, implementation and adaptive management.

The theory of change lays out the predicted cause and effect relationships between project or programme activities (or components), and the desired outcomes for the project.

Using the results of the previous three steps, the theory of change documents what has been learned in Steps 1, 2, and 3 and highlights the relationships between them (Figure 7).

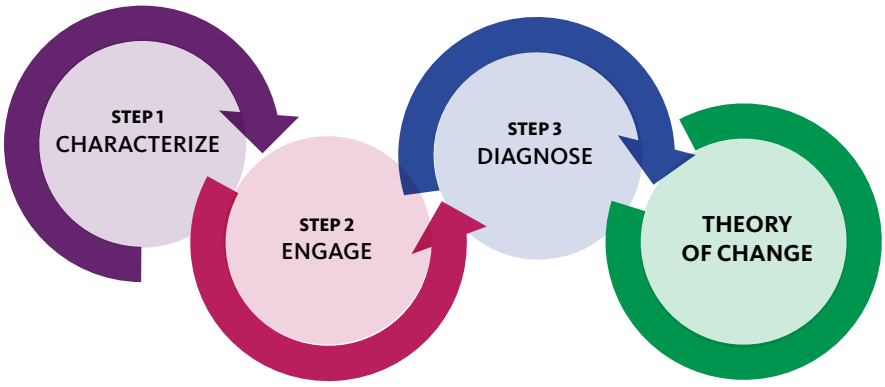


Figure 7. Information gathered in Steps 1, 2 and 3 is used to develop the theory of change.

Orders of outcomes

The theory of change delineates outcomes that lead to the desired long-term impact. One useful framework sets out four "orders" of outcomes: first order outcomes are conditions enabling the required change; second order outcomes are the necessary changes in behaviour; third order outcomes are the desired changes in the status of the source-to-sea system; and fourth order outcomes are benefits gained from successful implementation (Figure 8).

Theory of change

The theory of change describes the anticipated relationships between the orders of outcome, i.e., how impact will be transferred from initial activities to desired outcomes. The intermediate steps in the theory of change are the immediate or short-term outcomes that are deemed necessary to reach the long-term goal. The theory of change becomes the cornerstone for developing funding proposals and implementation plans in Step 5 and in determining the indicators to be monitored and subsequent adaptive management in Step 6.

The first to fourth order outcomes will be specific to the project or programme aims as well as the local context. Developing a theory of change when applying the source-to-sea approach requires considering how impacts are transferred across the source-to-sea system. How do actions in one segment of the source-to-sea system impact source-to-sea flows in upstream and/or downstream segments? The theory of change will focus on the unique characteristics of the source-to-sea flows, stakeholders, governance system and practices within the system boundary selected for the project or programme.

Intervention strategies are project or programme activities, or components, that are considered most likely to drive change from 1st to 2nd, 3rd and 4th orders of out-

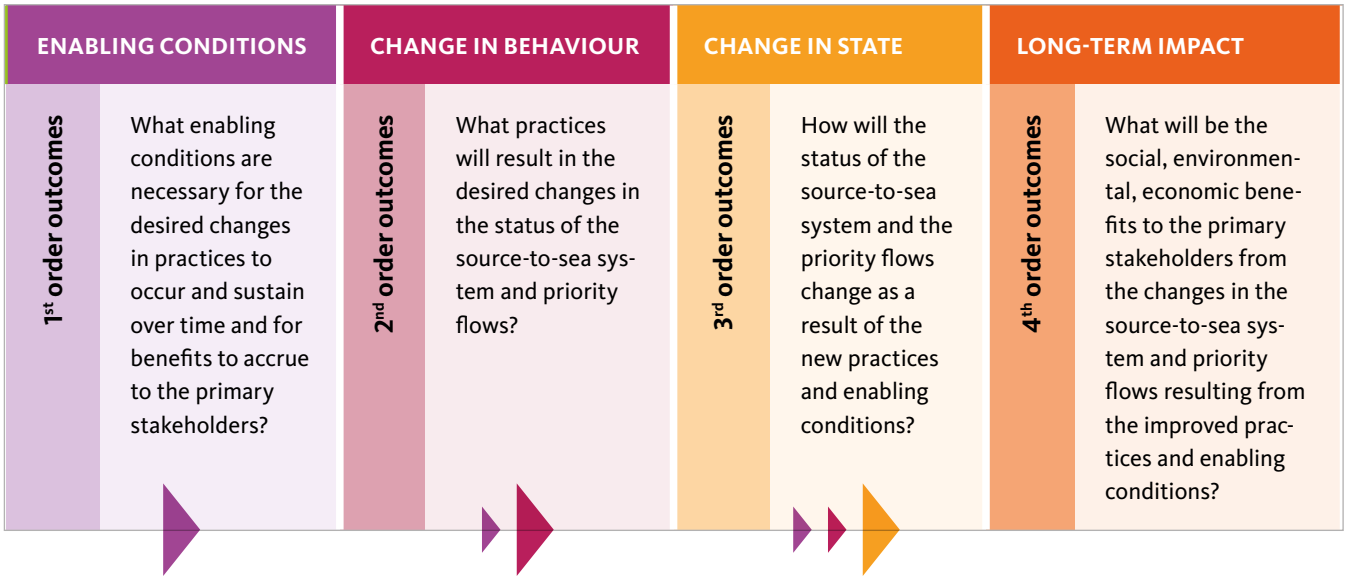
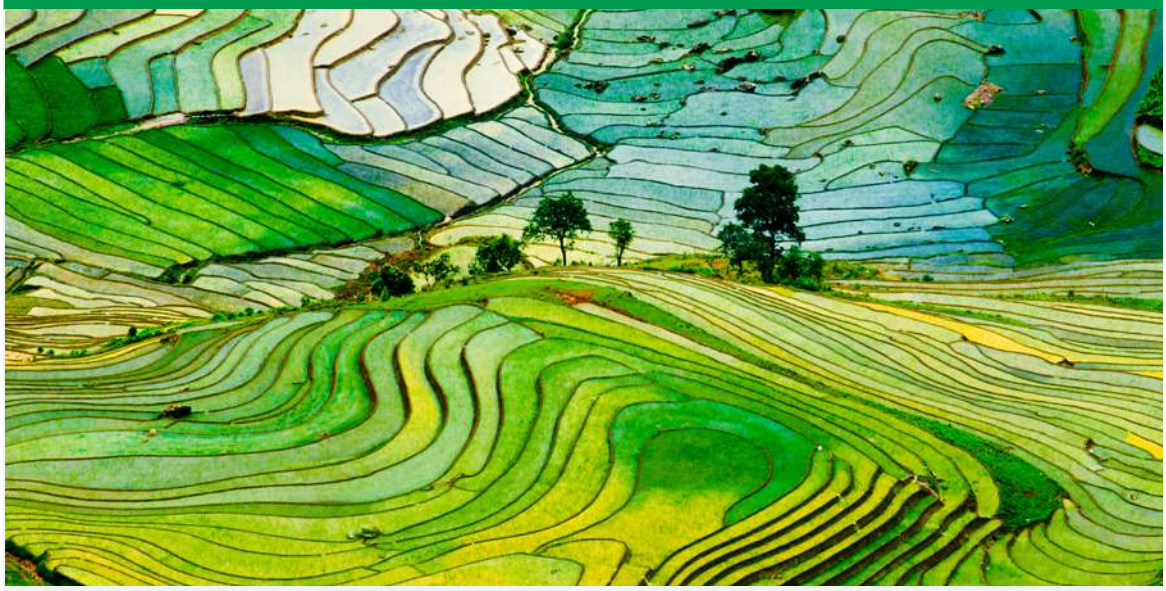


Figure 8. A theory of change framework for the source-to-sea approach – measurable outcomes are disaggregated into four "orders"

come. Documenting the theory of change and the expected stepwise results from the implementation of the project or programme activities, or components, makes the assumptions about the relationships between interventions and their effect explicit. It helps the project or programme team identify effective intervention strategies and can clarify which stakeholders to involve in each activity.

Intervention strategies may focus on one order of outcome, as described below, while being part of an overall plan for transitioning to the desired long-term impact.

INTERVENTION STRATEGIES FOR THE FOUR ORDERS OF OUTCOME



FIRST ORDER OUTCOMES | Here we focus on strategies to increase technical or governance capacity. The diagnosis of the governance system completed in Step 3 can be used to design interventions that for example strengthen institutions, new regulations or financial mechanisms. Other aims can be to raise engagement and political will, include stakeholder participation in decision making, ensure gender representation, etc. Of strategic importance is establishing the mechanisms for coordination, cooperation and collaboration across relevant source-to-sea segments.

SECOND ORDER OUTCOMES | Intervention strategies are designed to support the use of new practices by targeted stakeholders, specifically to reduce the alterations of source-to-sea flows and restore relevant aspects of the source-to-sea system that will supply benefits to the primary stakeholders. Project or programme activities, or components, will aim to improve practices used by targeted stakeholders, e.g. training in resource management practices, improved supply chains and access to market, new infrastructure, peer learning and user groups, financial investments, etc.

THIRD ORDER OUTCOMES | Focus is on intervention strategies that establish monitoring and assessment of process, stress reduction, environmental status and socio-economic status indicators and capture learning for dissemination and adaptive management.

FOURTH ORDER OUTCOMES | Although primarily a result of previous intervention strategies, project or programme activities need to be designed to ensure that social, environmental and economic benefits are delivered to primary stakeholders and sustained over time.

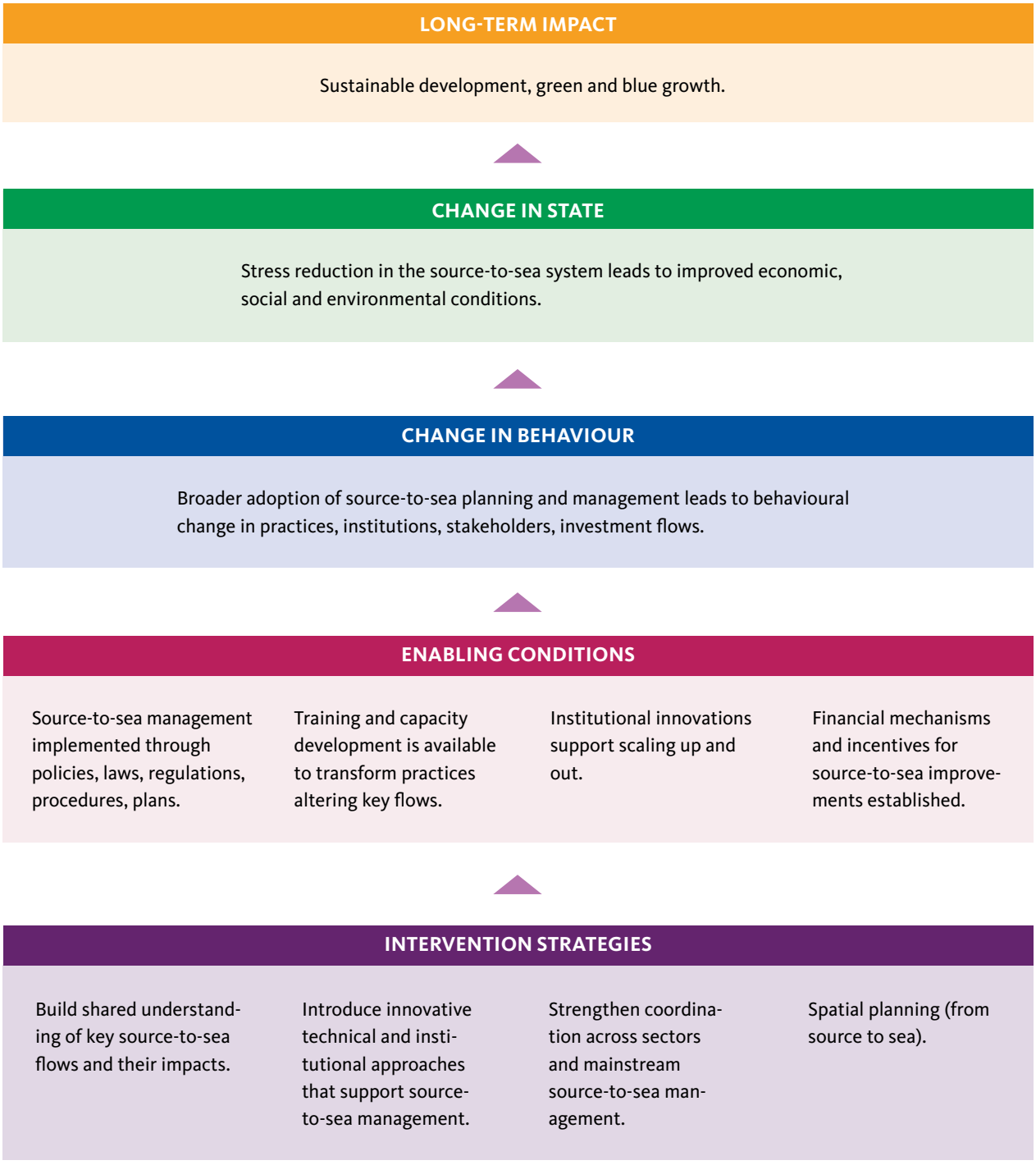


Figure 9. An example of a source-to-sea theory of change adapted from Tengberg & Valencia, 2017

Connecting the steps

The theory of change documented in Step 4 becomes the basis for monitoring and adaptive management in Step 6. The interventions strategies developed from the theory of change will be implemented in Step 5.

Step 4 Output

The output from Step 4 is:

1. Well-developed theory of change with documentation of assumptions and unknowns.
2. Table of intervention strategies, the stakeholders to engage and the linkages between intervention strategies and desired outcomes.

Step 5 Act

Fund and implement source-to-sea actions.

By following Steps 1–4, you should now be in a position where you're ready to develop the financing strategy and implementation plan. At Step 5 we reach the crucial test, to implement and finance our source-to-sea strategy.

Cadmium, a toxic heavy metal, is dumped as effluent from a phosphate mine directly into Togo's coastal waters, which are part of the Guinea Current Large Marine Ecosystem. **Photo: Christian Susan**

GUIDING QUESTIONS

1. **Are there financing partners or mechanisms that will support implementation of source-to-sea management?**
2. **What are the intervention strategies needed to achieve the four orders of outcome elaborated in the theory of change in Step 4?**
3. **What courses of action are needed to establish the conditions and commitments required to ensure long-term sustainability of source-to-sea capacity, funding and partnerships?**

Financing source-to-sea management

Funding a source-to-sea project or programme can follow in line with traditional projects, however, the advantage of the source-to-sea approach is that it may bring in new stakeholders who have an interest in the outcomes of the project. These may be, e.g., beneficiaries upstream or downstream of the project or programme activities, interest-based groups from different source-to-sea segments, development partners who have cross-sectoral interests or are operating on a broader geographic scale, etc. Identifying supporting and external stakeholders and engaging these stakeholders in the project or programme can introduce innovative forms of financing.

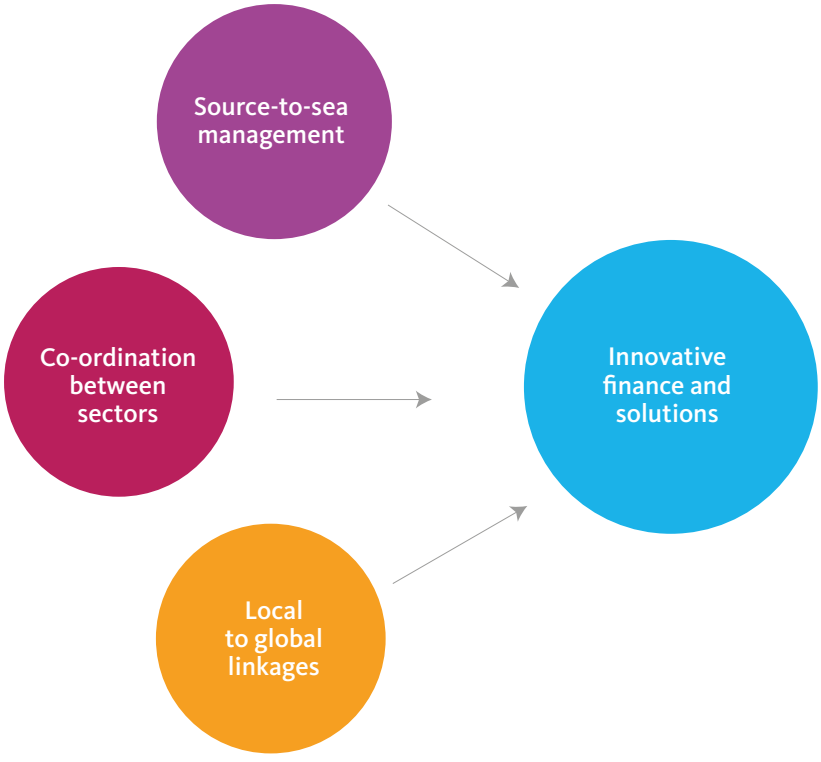


Figure 10. Bringing together upstream and downstream stakeholders and public and private sectors can create innovative financing opportunities for source-to-sea projects or programmes.

Funding of source-to-sea interventions can come from different sources, e.g., public, donor and/or private sector and can be leveraged through different mechanisms. Integrating source-to-sea priorities into public sector action plans and budgets is a strong way of leveraging the project or programme intervention strategies and desired outcomes for long-term sustainability. Multi-sectoral engagement, e.g., water resources, agriculture, fisheries, forestry, environment, coastal, marine, industrial, energy and transport sectors in the source-to-sea project or programme expands the opportunities for this integration of future funding for source-to-sea priorities. Which sectors to target depends on the priority flows, the targeted stakeholders and the practices resulting in alteration of priority flows, and the governance system.

Bilateral and multilateral donors provide funding in developing country contexts. This may include environmental and climate change funding from e.g. the Global Environment Facility and the Green Climate Fund as well as bilateral overseas development aid or investments from development banks. Philanthropic donors can also be a source of funds where issues being addressed by the project or programme are targeted in their philanthropy strategies.

As with the public sector funding, working with donors to adopt source-to-sea priorities in their strategies can provide leverage of and long-term sustainability for source-to-sea projects or programmes.

Public sector and donor funding are increasingly combined with innovative economic instruments for mobilisation of new and additional funding and coupled with positive incentives for managers of natural resources. This could include e.g., payment for ecosystem services (PES) and other incentive schemes such as facility and value chain certification in line with corporate social responsibility targets; investments in green infrastructure, public private partnerships (PPPs), internalised pricing of water, green bonds, etc.

Implementing source-to-sea management

The implementation plan is built from the theory of change developed in Step 4 and defines how the stakeholders identified in Step 2 will be involved in the project or programme and their specific roles and responsibilities in delivering the intended outcomes, the activities that will be undertaken for each intervention strategy and the timeline for their implementation. Figure 11 shows a participatory approach to the project or programme cycle that can be the basis for an implementation plan. The source-to-sea approach is cyclical as more is learned about the source-to-sea system through implementation and monitoring. As outcomes from intervention strategies are evaluated, stakeholders may identify new actions to be taken or may select new priority flows to address.

Establishing a participatory, adaptive approach is essential for the success of source-to-sea management.

The source-to-sea approach adds new opportunities for building support by including new stakeholders but also new challenges in establishing coordination, cooperation and collaboration across source-to-sea segments. The preparatory work of Steps 1–4 should smooth implementation of the project. However, it is important to remain realistic about timeframes for socializing the changes required to apply a

CASE STUDY | RIDGE TO REEF IN PACIFIC

Establishment of a regional community of practice

for a ridge-to-reef programme in small island developing states in the Pacific

The Pacific Islands Ridge-to-Reef National Priorities programme seeks to address pollution and threats from land-based activities. The project will establish national and regional platforms to share best practices and lessons learned.

Key drivers and threats to the region include: pollution of marine and freshwater supplies (including groundwater) from land-based activities; physical, ecological and hydrological modification of critical habitats; and excessive exploitation of living and non-living resources. The programme focuses on integrated water, land, forest and coastal management to preserve biodiversity, ecosystem services, store carbon, improve climate and disaster resilience and sustain livelihoods. It aims to build an enabling environment at the national level for linking Integrated Water Resources Management with Integrated Coastal Management into a new integrated Ridge-to-Reef (similar to source-to-sea) approach.

The project will establish national and regional platforms for managing information and sharing of best practices and lessons learned in integrated land, water, forest and coastal management, including climate change adaptation. An online 'results' portal will be developed for Results-Based Management training, the online submission of routine reports, and the routine sharing of Ridge-to-Reef programme results, including the geospatial presentation of results linked to related initiatives of the Global Environment Facility International Waters Learning Exchange and Resource Network (IW:LEARN) project. ●

source-to-sea approach. By completing these preparatory steps, the stakeholders' interests, positions, power and influence, and possible conflicts between stakeholders should be well understood. The social and power dynamics between stakeholders, as well as the levels of dependency on the source-to-sea flows – and their alterations – needs to be directly addressed in project or programme design and implementation. Completing a risk assessment and developing a risk mitigation strategy can help pre-empt derailment of the source-to-sea project or programme. Adaptive management will be necessary to ensure sustainability of source-to-sea management as political, social, economic and environmental conditions change.

Implementation of the source-to-sea approach should focus on building partnerships and developing the institutional and individual capacity for linking activities, impacts and outcomes across the source-to-sea continuum. Source-to-sea projects or programmes require coordination between sectors and across source-to-sea segments and initial intervention strategies may need to focus on developing these coordination mechanisms. These may be existing multi-stakeholder processes, to which source-to-sea activities are added, or it may be necessary to establish new pathways for coordination and collaboration. A knowledge management system such as the one established for the ridge-to-reef programme for small island developing states is one example of a mechanism to support regional coordination.

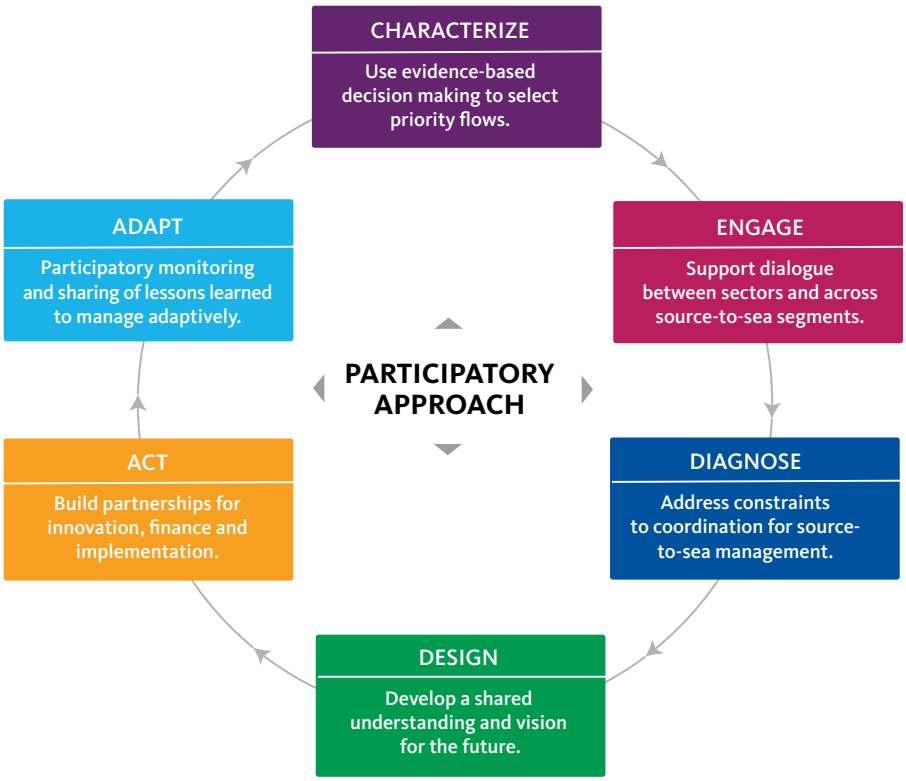


Figure 11. Implementation of source-to-sea project cycle using a participatory approach. This is an iterative process, as issues related to priority flows are addressed one can then move to secondary issues and so on.

Connecting the steps

In Step 5, intervention strategies that address the alterations in priority flows will derive benefits for the primary stakeholders and the source-to-sea system. The intended outcomes from their implementation will be monitored in Step 6. The results observed through the monitoring programme will form the basis for adaptive management.

Step 5 Output

The output from Step 5 is:

Funding and implementation plan with:

1. Sources of and mechanisms for public, donor and/or private sector sources of funding and their linkages to intervention strategies and desired outcomes.
2. Strategy for securing sustainable financing for source-to-sea priorities.
3. Description of intervention strategies with activity plan including:
    - strategies and mechanisms for coordination between sectors and across source-to-sea segments;
    - stakeholder mapping relative to the intervention strategies and desired outcomes;
    - risk assessment and risk mitigation plan; and
    - timelines for implementation, monitoring and evaluation.

Step 6 Adapt

Monitor outcomes, capture and disseminate learning and adaptively manage for continued success.

Critical to the success of any project or programme is monitoring, evaluation and adaptative management. This is especially true when implementing the source-to-sea approach as the impact of actions in one segment of the source-to-sea system on another may not be fully understood. Too often, analysis of cause and effect is limited to individual segments of the source-to-sea continuum.

Kigali, Rwanda – August 27, 2013. **Photo: Flamingo Photography | iStock**

GUIDING QUESTIONS

1 **What is the collaborative definition of the desired targets and their indicators resulting from the engagement of diverse stakeholders?**

2 **What is the appropriate set of indicators that will monitor progress toward source-to-sea first to fourth order outcomes?**

3 **Have the assumptions elaborated in the theory of change been confirmed or is there new learning about the relationships between intervention strategies and outcomes?**

4 **What are the lessons learned and how can these be disseminated to expand the application and success of source-to-sea management?**

Monitoring

The selection of indicators is an important step in confirming the assumptions underlying the theory of change and for providing stakeholders with the information they need to understand the impact of the project or programme. Engaging stakeholders in the selection of desired targets and indicators can help establish a commitment to the project or programme as well as capture individual stakeholder interests. Working toward a shared definition of targets and indicators that reflect stakeholder interests can be an initial step toward developing source-to-sea cooperation and building partnerships.

Indicators should be selected to monitor not only the progress in delivering the implementation plan but more importantly, to measure the intended outcomes of the project or programme (Figure 12). These indicators can follow the orders of outcome (as outlined in Step 4), i.e., indicators measuring:

- the successful establishment of the enabling conditions – process indicators;
- the changes in behaviour and practices used by the targeted stakeholders – stress reduction indicators;
- the changes in the status of the source-to-sea system and priority flows – environmental status indicators; and
- the progress toward the desired long-term impact – impact indicators.

With these indicators, the assumptions in the theory of change are being tested and can be revised, if needed. Indicators can also be selected to measure the degree to which source-to-sea management is being adopted by the different stakeholders and where it has been formalized in governance mechanisms such as laws, policies, procedures and regulations, funding strategies, research agendas, partnership agreements, etc.

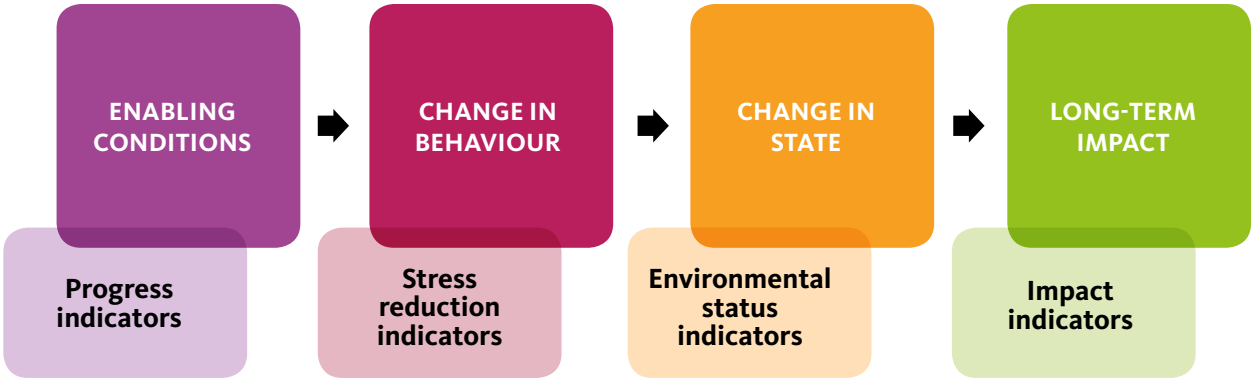


Figure 12. Process, stress reduction, environmental status and impact indicators monitor the four orders of outcome.

The following case study provides an example from the Global Environment Facility's International Waters portfolio of indicators based on the drivers, pressures, state, impacts, response (DPSIR) framework as applied in the Black Sea.

Adaptive management

Implementing a source-to-sea approach is founded on learning by doing and adaptive management. Monitoring and evaluation of selected indicators should feed into knowledge generation as well as directly into iterative learning cycles through adaptive management. Where there were unexpected results from the implementation of the intervention strategies, the interactions between source-to-sea segments and impact pathways across the source-to-sea continuum can be better understood.

A deeper understanding of the source-to-sea system, the stakeholders, governance system and practices may result in changes in the intervention strategies being implemented. As the source-to-sea approach has not been widely implemented, the evaluation of the monitored indicators can provide valuable information for expanding the understanding of source-to-sea linkages. As this learning grows, source-to-sea management can gain momentum and be applied at larger scales.

Throughout the project or programme and as the intervention strategies stimulate movement across the four orders of outcomes, significant value will come from documenting results, not only for the stakeholders directly involved but also for the broader community concerned with sustainable development. Supporting and external stakeholders may be well positioned to transfer lessons learned and communicate results not only in the locations where the project or programme was conducted but also globally.

Connecting the steps

The learning captured by the monitoring of selected indicators can be used to elaborate and verify the information gathered in Steps 1–3 and in a revision of the theory of change set down in Step 4.

CASE STUDY | DANUBE RIVER AND BLACK SEA

Indicators used for monitoring and evaluation of source-to-sea systems

In the 1970s and 1980s, the ecosystem of the western Black Sea collapsed. The most significant of the source-to-sea key flows degrading the Black Sea has been pollutants, in particular the massive flow of nitrogen and phosphorus into it.

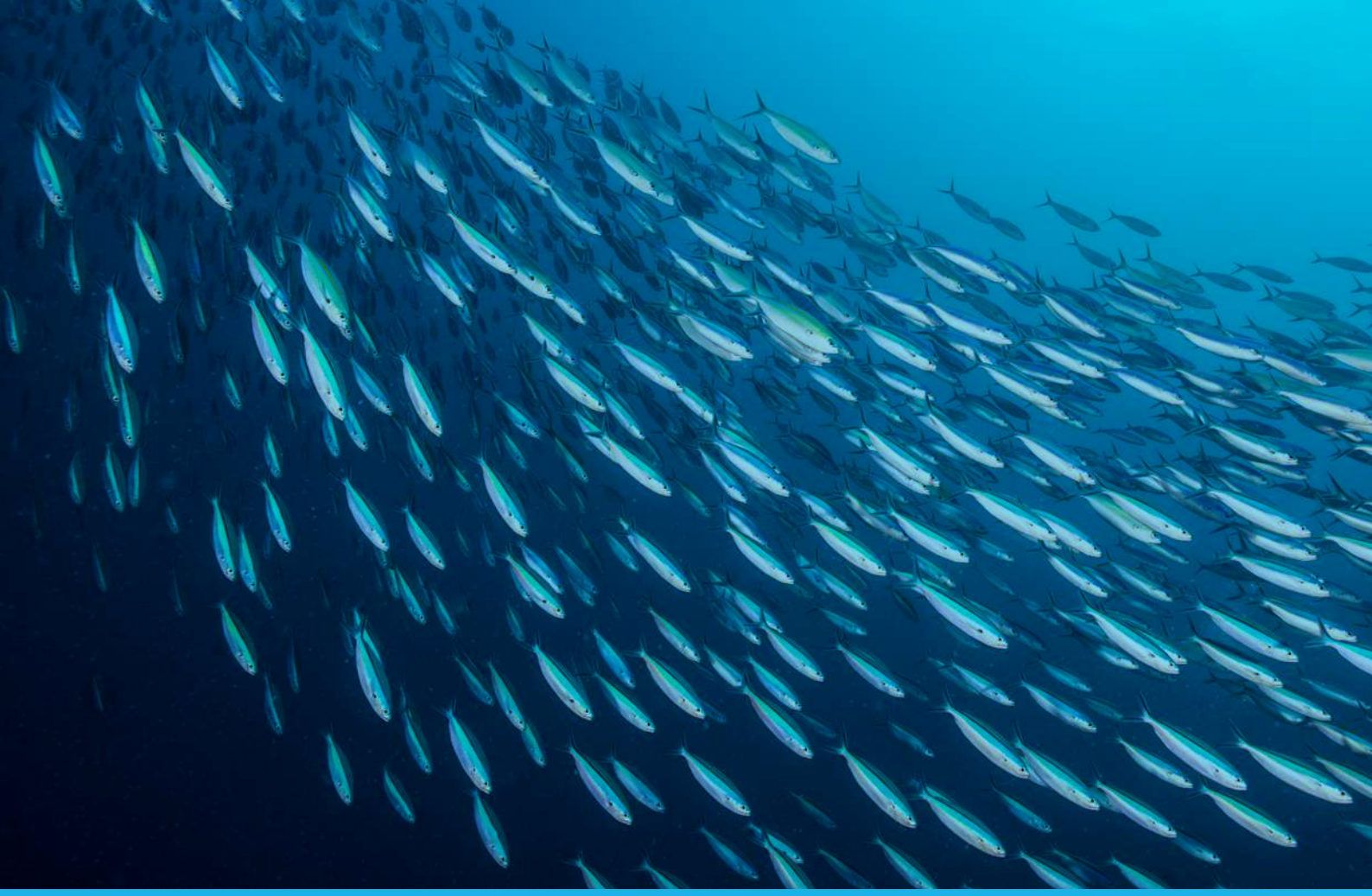
The main contributors of nitrogen and phosphorus have been run-off from agricultural activities, as well as municipal, domestic, and industrial sources, resulting in eutrophication and the development of a dead zone. The nutrients come from sources in 23 countries of the Black Sea drainage basin, carried through the rivers. Besides eutrophication, and the resulting massive die-offs of freshwater and marine life, the nutrient flow also severely reduces the quality of water available for human use.

The Global Environment Facility's investment in the Danube and Black Sea basins began in the early 1990s. Activities were designed to support the implementation of the Bucharest and Danube River Protection Conventions, and to reinforce the activities of the International Commission of the Danube River (ICPDR) and the Black Sea Commission, when they were established. Indicators to monitor and evaluate over 20 years of investments were designed using the DPSIR framework and include:

Process indicators	Stress reduction indicators	Status indicators
Agreement on the Trans-boundary Diagnostic Analysis	Operation of pollution reduction investments	Measured physical or biological parameters
Ministerial endorsement of Strategic Action Programme	Implementation of management practices – agriculture pollution reduction, soil erosion control, water use efficiency	Improved flow regimes – hydrological parameters related to groundwater use and recharge
Documentation of public involvement	Amount of wetland restored, protected areas established, fishing fleet removed, fisheries management measures, etc.	Ecological parameters – classes of fish, diversity
M&E plan, agreement on indicators and targets		Socio-economic parameters – local income/social conditions
Policy/legal/institutional reforms at national/regional level		

Early recognition of source-to-sea priorities i.e., the links between Danube River inflow and Black Sea environmental status is central to the success of efforts to reduce nutrient pollution flowing to the Black Sea. ●

Sources: Granit et al (2016) and project documents and terminal evaluations of projects: GEF ID 342, 399, 1460, 2042; 341, 397, 1580, 2263 available at https://www.thegef.org/gef/gef_projects_funding



Step 6 Output

The output from Step 6 is:

Funding and implementation plan with:

1. Monitoring plan indicating process, stress reduction, status and impact indicators, the methods of measurement and the timeframe for measuring and evaluating each indicator.
2. Project evaluation document with:
    - assumptions tested by project or programme implementation and identification of revisions needed in theory of change;
    - lessons learned;
    - communications and dissemination plan; and
    - recommendations for source-to-sea management and opportunities for scaling up the project or programme.

Conclusions

This six-step process for implementing the source-to-sea approach addresses critical challenges facing sustainable development – the interconnectedness of ecosystems and the indivisible nature of the Sustainable Development Goals. It presents practical steps for designing, implementing and evaluating projects or programmes by directly addressing the inherent connections between biophysical, social and economic linkages between land, freshwater, delta, estuary, coast, nearshore and ocean environments. Using the source-to-sea approach identifies strategic courses of action by focusing on key environmental alterations that in turn lead to economic, social and environmental benefits.

A wide variety of practices, tools and initiatives are available to support project and programme teams. Annex 2 presents a few key resources that may be of additional benefit to readers. The Action Platform for Source-to-Sea Management will continue to develop additional resources to assist project or programme teams, financiers and stakeholders in reaping benefits by addressing sustainable development from source to sea.

Annex 1

Forms of integrated management and their relevant source-to-sea segments

Governance approach	Applicable source-to-sea segments
TRANSBOUNDARY DIAGNOSTIC ANALYSIS (TDA)/STRATEGIC ACTION PROGRAM (SAP) | a collaborative process applied by Global Environment Facility (GEF) projects in multi-country surface water, groundwater and coastal/marine water systems to identify, quantify, and set priorities for environmental problems that are transboundary in nature (the TDA) and establish clear priorities for action to resolve the priority transboundary problems identified in the TDA (the SAP).	All source-to-sea segments depending upon the scope and system boundary of the project
SPATIAL PLANNING | embraces measures to coordinate the spatial impacts of sectoral policies, to achieve a more even distribution of economic development between regions than would otherwise be created by market forces, and to regulate the conversion of land and property uses.	Land resources and terrestrial systems (including urban), freshwater systems, estuaries/deltas
MARINE SPATIAL PLANNING (MSP) | marine spatial planning is an ecosystem-based, area-based, integrated, adaptive, strategic and participatory approach.	Nearshore waters, adjoining sea and continental shelf, open ocean
SUSTAINABLE FOREST MANAGEMENT (SFM) | a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations.	Land resources and terrestrial segments, estuaries/deltas and nearshore coast (mangroves)
SUSTAINABLE LAND MANAGEMENT (SLM) | the adoption of land use systems that, through appropriate management practice, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources.	Land resources and terrestrial segments, deltas and coasts

Governance approach	Applicable source-to-sea segments
LAND RESOURCES PLANNING (LRP) | the systematic assessment of land potential and alternatives for optimal land use and improved economic and social conditions through participatory processes engaging multiple sectors, multi-stakeholders and a scale-dependent process.	Land resources and terrestrial segments, deltas
INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) | coordination of development and management of water, land and other resources for maximizing of economic results and social welfare with no compromise on the environment.	Land resources and terrestrial systems (river basins), freshwater systems, estuaries/deltas
ENVIRONMENTAL FLOWS MANAGEMENT | provides the water flows needed to sustain freshwater and estuarine ecosystems in coexistence with agriculture, industry and cities.	Freshwater systems, estuaries/deltas
INTEGRATED COASTAL MANAGEMENT (ICM) | ICM evolved from the practical need to plan and manage the various economic activities that occur in coastal areas, regulate human behaviour, coordinate policy and management interventions, and integrate the use of coastal waters into land use planning.	Land resources and terrestrial systems (coastal, including urban), estuaries/deltas, coast and nearshore waters
INTEGRATED COASTAL AREA AND RIVER BASIN MANAGEMENT (ICARM) | ICARM is not a new management approach, but rather links the management approaches for coasts and rivers.	Land resources and terrestrial systems (river basins), freshwater systems, estuaries/deltas, coast and nearshore waters
ECOSYSTEM APPROACH TO FISHERIES MANAGEMENT (EAFM) | strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.	Freshwater systems, estuaries/deltas, coast and nearshore waters, adjoining sea and continental shelf, open ocean

Annex 2

Source-to-sea resources

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About the S2S Platform

The Action Platform for Source-to-Sea Management (S2S Platform) is a multi-stakeholder initiative that exchanges and generates knowledge, and supports joint action for improved management of land, freshwater, coastal and marine environments. The S2S Platform has been successful in developing a shared knowledge base and in securing adoption of the source-to-sea approach in policies, strategies and funding mechanisms. Membership in the platform is open to all stakeholders that are committed to improving management coherence and coordination from source to sea.

The S2S Platform Secretariat is hosted and coordinated by Stockholm International Water Institute (SIWI).

For more information on the S2S Platform, visit www.siwi.org/source-to-sea

Action Platform for Source-to-Sea Management Partners:

AGWA Alliance for Global Water Adaptation

Alliance for Water Stewardship

Benguela Current Commission

Commission on the Protection of the Black Sea Against Pollution

DeltAlliance

FAO Fiat Panis

gef

Global Water Partnership

icpdr iksd

IUCN

IWRA

ISPRA

PEMSEA

Race for the Baltic

Ramsar

SEI Stockholm Environment Institute

SIWI

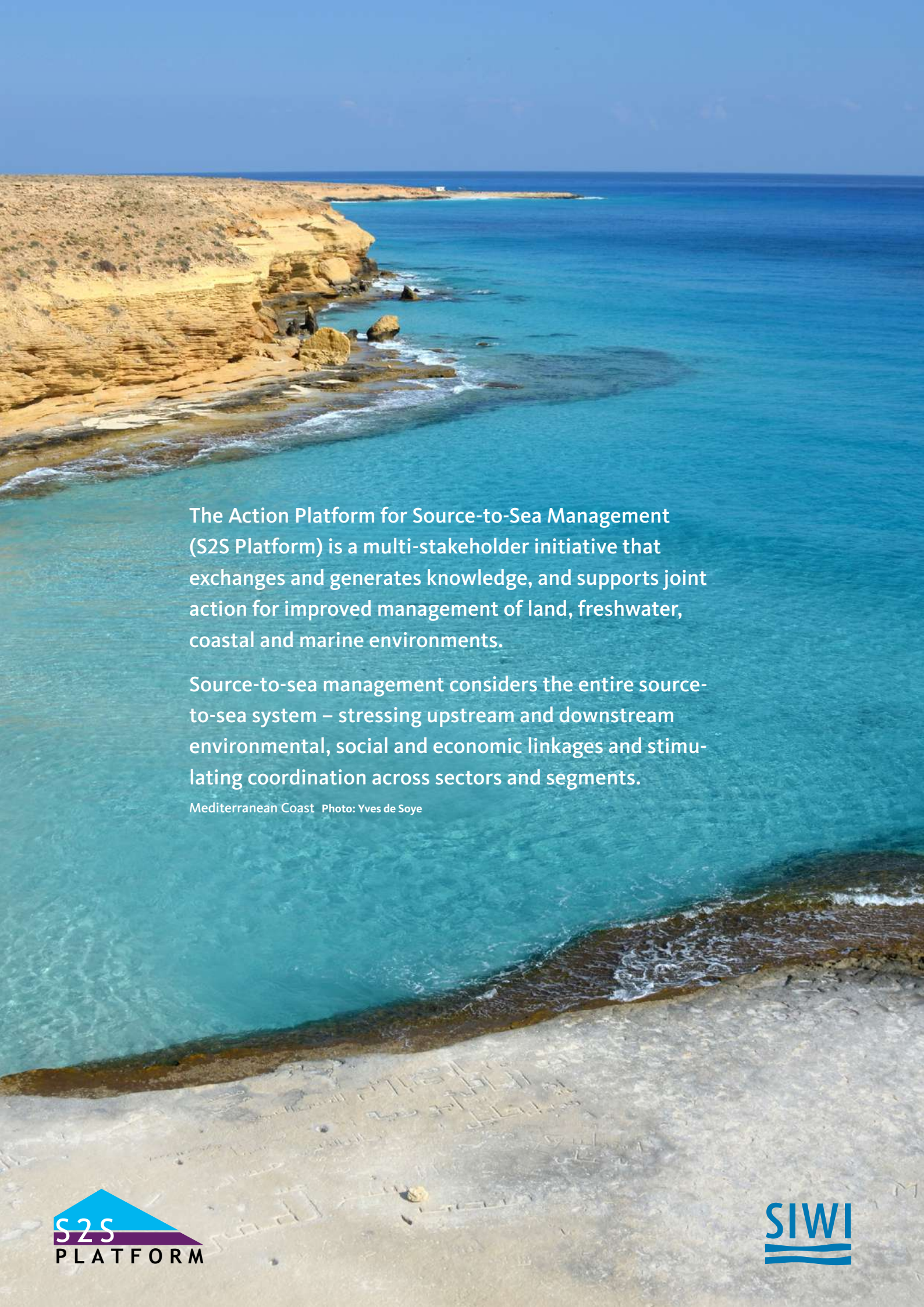
UNDP Empowered lives. Resilient nations.

UNEP-DHI Partnership Centre on Water and Environment

GPA

Xiamen University

Water-Culture Institute



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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.

Mediterranean Coast **Photo: Yves de Soye**

S2S PLATFORM

SIWI