# Source-to-sea risk and prioritisation – evidence and methods review

## Section 1: Project Overview

### Introduction

The Centre of Expertise for Waters (CREW) intends to commission a **capacity building project** aligned with CREW's three themes. The project aims to deliver an evidence synthesis and review, gap analysis, and a methodological review focused on land- and freshwater-based sources of pressures relevant to the sensitivities of key assets in marine and estuarine waters. The outputs will inform the best use of existing data and information when developing a future framework and tool.

### Background

At present, there is limited direct measurement of how the marine environment is exposed to pressures originating from terrestrial and freshwater systems (often described as 'source-to-sea' pressures). Where data do exist, they are often collected at spatial and temporal scales that are too coarse to effectively inform management actions or to target more detailed investigation. While water classification information for freshwater environments provides a useful initial proxy for assessing potential risk to downstream marine interests, it is constrained by limited resolution and does not reflect all relevant risks.

There is a clear opportunity to make more effective use of existing data and information, so that an informed view can be developed of land characteristics, land use, and associated indicators of anthropogenic pressures relevant to the marine environment. This will help identify pressures that create or mitigate cumulative risks to key environmental assets in the marine environment, while recognising the current limitations of available datasets. In the longer-term, there is potential for innovative solutions that provide new, higher resolution data and models regarding the condition of the marine environment and associated land-sourced pressures, but in the near-term we must focus on how to make good use of existing data and information.

The realities of the interconnected nature-climate-pollution 'triple crisis'[1] mean that approaches to delivering the aims of River Basin Management Planning (RBMP), to protect and improve our water environment, need to take a more comprehensive, systems-based approach. Scotland is not immune to these interacting pressures, and there is a growing and urgent need to support mitigation, adaptation, and resilience-building in the face of an uncertain future.

### Knowledge gap

Decisions on terrestrial and freshwater environmental improvement actions currently take limited account of their downstream effects on estuarine and marine environments, and assessment frameworks tend to focus on freshwater margins rather than whole catchments. While current governance regimes, including RBMP, have enabled environmental protections and improvements, limitations arise from the resolution, extent and type of evidence deployed. These limitations risk overlooking locally significant pressures, the cumulative and interacting effects of multiple small-scale impacts, and the inherent effects and dependencies between land, freshwater and marine systems.

[1] Triple-crisis - as described by the UN Global Foresight Report and reflected in Scottish Government's draft Environment Strategy.

Although understanding of these issues will continue to evolve, there is an opportunity to better account for source-to-sea connectivity without immediate reliance on new data collection or expanded marine monitoring. A small number of third-party, risk-based tools (e.g. https://scimap.org.uk/) exist, demonstrating the potential to support integrated source-to sea assessment, but without adaptation to or uptake within Scottish policy and regulatory contexts to date. This project therefore aims to deliver a preparatory review of existing Scottish evidence and methods to support more effective use of available data and information for risk-based appraisal of land-sourced pressures on the estuarine and marine environment in Scotland.

## Policy relevance

Relevant policy and regulatory activities operate at multiple spatial scales, and this project intends to work across all of these, with a primary focus on informing delivery of local policy, regulation, and action. In the receiving (marine) environment, this includes marine protected areas, local habitat quality, bathing and shellfish growing waters, and enabling restoration activity. This project will also contribute to regional outcomes (e.g. waterbody classification and spatial planning), national priorities (e.g. Good Environmental Status; the Scottish Biodiversity Strategy; the Climate Adaptation Programme; and the Wild Salmon Strategy) and international commitments (e.g. the Sustainable Development Goals).

Many Scottish Government strategies seek to manage the inherently connected systems of land and sea in a coherent way, an ambition articulated clearly in Scotland's third Land Use Strategy (LUS3). However, implementation to date has been variable across policy areas. While RBMP remains the most established mechanism for delivering integrated environmental improvements, key limitations include the spatial and temporal resolution/quality of available data for transitional and coastal water bodies, and a tendency for consideration of the source of pressures to focus on freshwater margins rather than whole catchments.

This project is timely. Preparation of the next RBMP cycle is underway alongside development of the Fourth Land Use Strategy (LUS4), and revision of the National Marine Plan (NMP) is explicitly considering draft policies and decision-making processes relating to land-sea interaction and cumulative impacts. Recent consultations for informing NMP2 have identified the need to strengthen source-to-sea considerations for managing pressures, including water quality, marine litter, and pressure on diadromous fish. The Marine & Coastal Restoration Plan similarly emphasises the importance of addressing terrestrial sources of pressures that may undermine marine restoration outcomes.

## Aim

This project aims to collate and review evidence and methods as a preparatory step towards a future phase 2 project (outwith CREW) that would design and develop a source-to-sea 'risk and prioritisation' framework with a geospatial tool, for use in a wide range of policy, regulatory and other decision-making contexts[2] *(see the Beyond Impact specification section for more information).*

This project aims to move beyond reductionist approaches that link specific sensitivities to specific sources of relevant pressures, and instead embraces complexities by supporting a more holistic, strategic appraisal of patterns of land-use, land-management and related environmental conditions. To enable robust consideration of cumulative and interacting pressures relevant to the sensitivities of key marine natural assets when prioritising areas for remedial actions on land, this project will identify, collate and review datasets that reflect multiple relevant land-sourced pressures on marine interests.

Specifically, this project will deliver an evidence synthesis and review, a gap analysis, and a methodological review focused on land- and freshwater-based sources of pressures relevant to the sensitivities of key assets in marine and estuarine waters. These outputs will support the effective use of existing data and information in the development of any future framework and tool. To address the project aim the following questions should be addressed:

1. Which terrestrial and freshwater variables and landscape / land-use / environmental characteristics are most relevant[3] in creating, indicating and/or mitigating cumulative risk for key natural assets[4] in transitional and coastal / marine waterbodies?
    - This should consider whole catchments, not just waterbodies and their marginal lands.
    - This should include consideration of climate-related pressures in relation to additional or elevated risks or resilience issues associated with climate change (including interaction with other pressures).
2. For the variables and characteristics identified under Q1, what spatial data and information layers (including proxy measures) are available, including but not limited to a review of CREW project archives? How well does the data align with the variables identified in Q1?
    - Please identify limitations or data accessibility issues, and information and data layers with promising potential but insufficient accessible detail for a full critique.
    - Please distinguish national (Scotland-wide) from regional/fragmented data sets, for consideration of useful datasets that could be prioritised for expansion of their geographical coverage.

[2] Prototyping a tool or model is beyond the scope of this CREW project.

[3] Relevance can be informed by an understanding of the relative sensitivity of different marine assets, using the categorisation of pressure types within the Feature Activity Sensitivity Tool

[4] The steering group will liaise with the successful contractors to specify the marine assets that the project focuses upon, but we expect these to be (1) features of Marine Protected Areas that would be sensitive to pressures originating on land or in freshwater, (2) Priority Marine Features that are outside of MPAs but have relevant sensitivities, (3) species and habitats that are targets for marine restoration and have relevant sensitivities, (4) Designated Bathing Waters, and (5) Designated Shellfish Waters.

3. What are the key evidence gaps, and accordingly your recommendations for strategic research or environmental surveillance?
    - Please include consideration of knowledge of pressures, sensitivities and effects on environmental condition and ecosystem services.
    - Please consider how we measure these pressures and effects, directly or through indicators and proxies.
4. What lessons can be learned from existing methods, tools, and examples of risk-based geospatial analysis, and what recent or emerging advances in GIS applications and data management systems should be considered?
    - Please review options for consideration, making recommendations where possible for subsequent development of a risk and prioritisation framework and tool. This may include, but is not limited to, consideration of weighting systems in environmental risk frameworks.

## Deliverables

- **Final report** of 25-30 pages, excluding annexes and the bibliography, including:
    - the approach to and conclusions of the evidence synthesis and review,
    - a gap analysis,
    - a review of methods and capabilities in geospatial analysis of environmental risk that would be transferrable to source-to-sea connectivity issues,
    - a concise set of recommendations, and
    - cover image(s) with associated photo credits
- **Spreadsheet database** that catalogues and critically appraises the availability and relevance of numerous sources of data and information.
- **Plain English summary** of the project aims and results (1-2 page)
- **Website summary** (approximately 200 words)
- **Communications and impact plan**, developed with support from CREW at the start of the project and refined throughout delivery.

**Events/meetings**

- 3 Online Project Steering Group meetings (throughout the project lifecycle[5])

[5] Please note, CREW requests a brief written update c. two weeks prior to project steering group meetings.

## Intended impacts

There are multiple pathways for a project to achieve impact, and multiple factors that can impact the project's ability to achieve what it intends to do; both along the project lifecycle (A.IMPACT) and beyond project completion (B.IMPACT) (Figure 1).

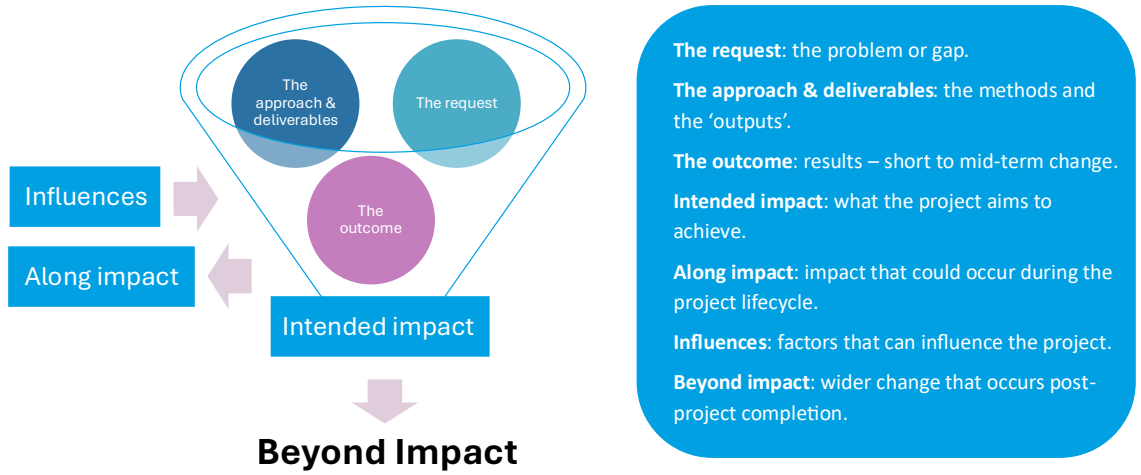


*Figure 1:Pathways to impact*

### Along Impact *(A.Impact)*:

These stakeholders will be part of the project steering group: NatureScot, SEPA, Scottish Government and the Scottish Government Marine Directorate.

### Beyond Impact *(B.Impact)*:

This proposal provides an opportunity to strengthen the supporting evidence base and improve understanding of cumulative effects across the source-to-sea system, in ways that can better inform management of complex pressures.

The project will support improved consideration of sensitivities in transitional and coastal water bodies, and enhanced identification of likely terrestrial and freshwater sources of pressures, both individually and cumulatively. In doing so, it will help to inform the prioritisation of preventative and remedial actions across multiple scales of governance, and with coordination across multiple divisions of government.

It is anticipated that the outputs will inform a phase 2 project (outwith CREW) to develop a decision-support tool that makes best use of existing information, can incorporate future advances in data and modelling, and supports appraisal of where and how land-sourced pressures are concentrated or distributed across catchments. Consequently, this project is also intended to ultimately inform further work across a range of programmes relating to the natural environment and may have application in the following areas:

- River Basin Management Planning (from 2027);
- Prioritisation of Landscape/catchment scale nature restoration including the attraction of major private investment;
- NatureScot landscape scale natural capital tool – targeting nature enhancement effort and investments where benefits can be maximised, including smaller landholdings;

- Development and implementation of a Scottish Rivers Fund, currently progressing through FIRNS funding, which includes ambitions to align and interact with the Scottish Marine Environment Enhancement Fund to deliver source-to-sea actions;
- Scotland's Marine and Coastal Restoration Plan, regarding the management of source-to-sea pressures that may affect the success of marine restoration efforts & investments;
- Reform of NatureScot's Protected Areas Monitoring Programme;
- Evolving approaches to cumulative effects assessments, informing the Strategic Environmental Assessment of marine plans and broader state-of-seas reporting requirements at Scottish, UK and international levels.

## Section 2: Further information for applicants

### Eligibility

CREW Capacity Building funding is open to applications from **all relevant Scottish HEIs and Research Institutes (approved subcontractors)**. One eligible organisation must lead the bid, however an eligible organisation can sub-contract work in accordance with the Grant Terms which would include putting in place an appropriate agreement with the relevant sub-contractor(s) (updated December 2022). Any UK based HEI, RI or SME can be sub-contracted. Where successful, CREW funding would be subject to agreement to the CREW Grant Offer Letter and T&Cs ("Grant Terms"). CREW encourages applications from experienced to early career researchers (ECRs) under the supervision and mentorship of experienced researchers.

### Expectations and award criteria

A copy of expectations and the award criteria are provided on page 7 and 8 respectively.

### Project management

Day-to-day communication will be between the research/review team (the contractor) and a CREW Project Manager and is likely to involve short catchups as agreed.

### Communications and impact

CREW's impact officer will engage with the research team and project steering group on any agreed upon comms and impact activities throughout the project and for post project evaluation.

### Project steering group

A CREW representative, and representatives of Scottish Government and its delivery partners, will form part of the project steering group. They will meet with the preferred bidder(s) for a pre-contract meeting. A pre-contract meeting between will take place approximately **2nd, 7th or 8th April 2026.**

### Anticipated timescale (c. 9.5 months)

- The project will commence on the **13th April 2026,** depending on contract processing and signage.
- The 1st PSG meeting should be held **in late May 2026.** Project progress should be presented, with an opportunity for the Project Steering Group to review any initial work in progress.
- A first draft of the report and spreadsheet database should be submitted by the **14th August 2026**. *Please allow 2 weeks for the project steering group to review the draft.*

- The 2nd PSG meeting should be held **in early September 2026**, following the project steering group review period.
- A second draft of the report and spreadsheet database, and first draft of the plain English summary should be submitted by the **6th November 2026.** *Please allow 2 weeks for the project steering group to review the draft.*
- The 3rd PSG meeting should be held **at the end of November 2026**, following the project steering group review period.
- A final copy of all draft outputs should be submitted by the **8th January 2027.** *Please allow 2 weeks for the project steering group to review the draft.*
- All final outputs should be submitted by the **29th January 2027** for signed off by the CREW Director and formatting.

## Funding

The maximum amount of funding available **exclusive of VAT** (where applicable) is **£90,000.**

## Submitting a proposal

Please complete a **CREW Capacity Building Application form** outlining your proposal.

Proposals need to be submitted to Procurement@crew.ac.uk for evaluation **by 15:00 on Monday 9th March 2026.** We aim to notify the preferred bidder **by 23rd March 2026.**

Please contact Procurement@crew.ac.uk **by 2nd March 2026** if you would like any clarification on any of the above. You should highlight any potential conflicts of interest in your proposal. For queries about what may constitute a potential conflict of interest please contact the CREW Manager (Nikki.Dodd@hutton.ac.uk).

## Expectations

| No. | Criteria | Descriptor |
|---|---|---|
| 1 | Duration | The proposed duration will align closely to the details provided in the anticipated timescales section of the specification. |
| 2 | Staff time and effort | The proposed allocation of staff time and effort is appropriate and includes all deliverables. The proposal provides a commitment that named staff members will be available to work on the contract if the bid is successful. For any unnamed staff, appropriate risk identification and mitigation measures are provided. |
| 3 | Project costs | The estimated breakdown of project costs is realistic and inclusive of all deliverables. |

## Award criteria

| No. | Criteria | Descriptor |
|---|---|---|
| 1 | Understanding the project ask and policy background | The proposal should include an introduction which demonstrates a clear understanding of the project requirements. This should include an understanding of the policy background and the supporting role of this project; the need for this research; the project aim; and how the proposal will address this aim. |
| 2 | Proposed methodology | The proposal should demonstrate a high quality and workable methodology, including: how the evidence will be identified, reviewed and assessed; consulting relevant stakeholders and/or experts where appropriate to address the key questions and produce the deliverables in |

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|---|---|---|
| | | the timescales required. It should explain the suitability, robustness and limitations of the proposed methodology. |
| 3 | Milestones | The project milestones are logical, practical and include all deliverables. |
| 4 | Project Management | The staff, resources and expertise are appropriate for conducting the proposed project. The proposal should name the project lead and outline their project management experience. |
| 5 | General and specific topic expertise and experience | The proposal should provide details of individual staff members who will work on this project and demonstrate how they will meet the project requirements, specifically:<br>- general research experience and expertise;<br>- **specific experience and expertise on the topics of (a) marine and estuarine environmental sensitivities to human pressures, (b) spatial data and information regarding the use, management and environmental conditions of Scottish land and freshwater, and (c) risk-based geospatial analysis.** |
| 6 | General communication and deliverables | The proposal should describe the approach to producing the deliverables, which will be published on the CREW website. It should detail who will take lead responsibility for report-writing and overall report quality. It should provide examples of previously published reports in which they have been involved. |
| 7 | Quality assurance | The proposal should provide details of quality assurance procedures to demonstrate how the contract will be continuously delivered to a high standard. It should specifically address issues of quality control at different stages of the project, including evidence gathering, analysis and report writing. It should include a timetable for delivery of tasks, project milestones and allocation of staff and staff time against each task, covering the duration of the contract. |
| 8 | Risk | The proposal should provide a risk assessment matrix detailing any risks identified in relation to the delivery of this contract, and proposed mitigation measures to minimise their probability and impact, focused particularly on risk to completion on time. |

## Annex A. Relevant reports, studies and policies

- Kellock *et al*. (2023). Source to Sea - enabling coherent, efficient and synergistic outcomes. NatureScot Research Report 1343. - A previous collaboration between NatureScot, SEPA and the University of Stirling explored the importance of, challenges to, and opportunities and enabling actions for, an improved source-to-sea approach. Relevant conclusions include the importance of data and evidence systems that span the source-to-sea system.
- The 2020 Scottish Marine Assessment highlights knowledge gaps that includes spatial coverage of data on nutrient and metal inputs via rivers, possible underestimation of toxin occurrence, and a general need for spatially resolved data on pressures/activities, biological receptors and physical characteristics of the environment.
- Bridging the Gaps: Source-to-Sea Research for Scotland's Environmental Future – this SEFARI project flags a number of relevant challenges for the science and policy communities – which this project would go some way to progressing.

The specification has broad relevance to:

- CREWs 2025 'Future Research and Policy Priorities in the Scottish Water Sector' – inherent to source-to-sea approaches are the pursuit of multiple benefits across land and sea, and across sectors, communities and disciplines. As such, there should be complementarity across most of the stated priorities.
- The 2027-2032 Environment, Natural Resources and Agriculture Research Strategy – the proposed project is relevant to all draft Missions identified in the recent consultation, and in particular to the 'challenges' and 'areas of research interest' under the missions of 'Delivering climate-positive and resilient landscapes' and, 'Restoring nature and protecting our environment'. In parallel with the ENRA research strategy, the Scottish Government's published (August 2025) Areas of Research Interest for Marine and Freshwater includes many relevant research questions and an overall emphasis on the need "to understand these connections and develop integrated approaches to management across the land-sea interface".