VALMAS

Valuing Marine Artificial Structures

Decision Support Tools Fact Sheet Collection

About this collection

This collection of decision support tool (DST) fact sheets provides accessible summaries of the tools being developed within the VALMAS (The Value of Marine Artificial Structures) project. Each fact sheet describes a single tool: what it does, how it works, the information it provides, and its specific role in evaluating the environmental, social, and economic implications of marine artificial structures (MAS).

Together, the tools form an integrated decision-support framework that combines ecosystem modelling, evidence synthesis, spatial optimisation, marine net gain approaches, and federated data systems to support sustainable, transparent, and evidence-based decision-making. The framework spans the full lifecycle of marine infrastructure—from construction and operation through to decommissioning—and enables the assessment of marine artificial structures across a range of future marine management scenarios.

The three decision support tools presented in this collection represent the current suite of tools within VALMAS. As the project progresses, the suite may be expanded to include additional tools or approaches, where appropriate, in response to stakeholder needs and emerging requirements. This reflects the project's commitment to exploring existing capabilities and identifying where further decision-support approaches may be needed.

The suite is designed to be read either as individual fact sheets or as a complete collection. The tools are being co-developed with stakeholders to ensure they are accessible, transparent, and practical for real-world application, making the collection relevant to researchers, environmental managers, regulators, policymakers, industry, and other marine stakeholders.

DECISION SUPPORT TOOLS IN THIS COLLECTION

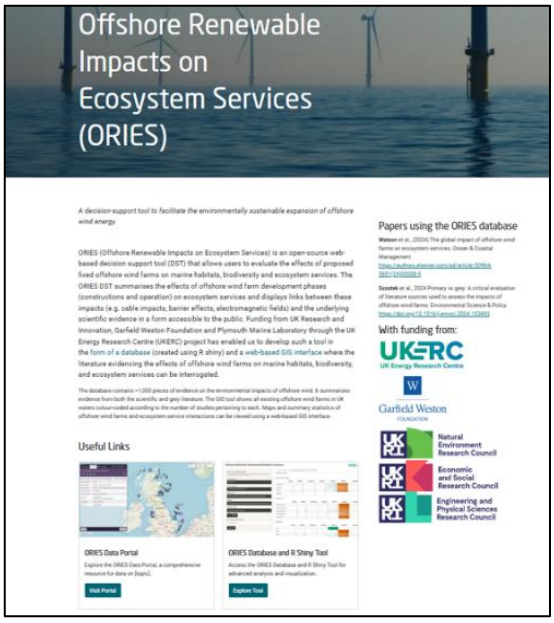
ORIES	Interactive evidence synthesis platform that collates environmental, social, and economic evidence related to marine artificial structures.
ASPACE	AI-assisted spatial prioritisation platform designed to support climate-resilient and socially acceptable marine spatial planning
StrathE2E web application	Web application that provides interactive visualisation of StrathE2E model outputs, enabling users to explore scenarios and support evidence-based marine management

QUICK LINKS

- ORIES
- ASPACE
- StrathE2E

© VALMAS Project 2025

ORIES



Website Link ORIES WEBSITE

Offshore Renewable Impacts on Ecosystem Services (ORIES) is an open-source database and set of decision-support tools that brings together scientific evidence on how offshore wind farms affect marine habitats, biodiversity and the ecosystem services people rely on.

The ORIES toolkit was originally developed by Plymouth Marine Laboratory (PML). The version used in VALMAS builds on this framework by integrating oil and gas infrastructure into the assessment and has been supported through funding from the UK Energy Research Centre (UKERC) and the Garfield Weston Foundation to evaluate the environmental and socio-economic implications of marine artificial structures.

AT A GLANCE

Tool Type	*Web application / R Shiny*	**Spatial Scope**	*Global (Database tool) UK (GIS tool)*
Primary Inputs	*Evidence synthesis, spatial datasets*	**Temporal Scope**	*Evidence from 2012-2026*
Primary Outputs	*Visualisations, scenario comparisons, decision metrics, maps, reports*	**Lead VALMAS Contact**	*Dr Steve Watson stw@pml.ac.uk* *Andrew Edwards-Jones aej@pml.ac.uk*

WHAT IS ORIES?

Offshore Renewable Impacts on Ecosystem Services (ORIES) is an open-source database and set of decision-support tools that brings together scientific evidence on how offshore wind farms affect marine habitats, biodiversity and the ecosystem services people rely on. It compiles more than 1,300 pieces of peer-reviewed and grey literature evidence and presents it through a user-friendly database (created using R shiny) and web-based GIS interface with summary statistics. ORIES helps users rapidly understand what is known - and what remains uncertain - about environmental and societal impacts across the lifecycle of offshore wind (construction, operation and decommissioning) and across different ecosystem services.

Ecosystem services are the benefits that people obtain from healthy marine ecosystems, including provisioning services such as seafood production, regulating services such as climate regulation and coastal protection, cultural services such as recreation and tourism, and supporting services that maintain biodiversity and ecosystem functioning. The tool highlights whether reported impacts are positive, negative, or have no impact and identifies where evidence is strong or limited, and supports transparent, evidence-based marine planning, environmental assessment, policy development, and future research prioritisation.

© VALMAS Project 2025

Key Features

- *Interrogates global evidence databases to identify and summarise the available evidence for marine artificial structures (MAS).*
- *Enables exploration of spatial evidence layers through interactive maps and geospatial visualisation.*
- *Compares ecosystem service outcomes associated with different types of MAS, management options, and future scenarios.*
- *Evaluates environmental, social, and economic impacts across the full lifecycle of MAS, including construction, operation, and decommissioning, under multiple pressures.*

Typical Applications

- *Supporting evidence-based marine spatial planning and strategic decision-making.*
- *Informing environmental impact assessments and marine licensing processes.*
- *Evaluating trade-offs between alternative infrastructure designs, management strategies, and decommissioning options.*
- *Identifying knowledge gaps and areas where additional evidence or monitoring is required.*
- *Providing transparent, accessible evidence to support policy development, industry decision-making, and stakeholder engagement.*

ROLE WITHIN VALMAS

ORIES provides the evidence synthesis component of the VALMAS decision-support framework, bringing together global scientific evidence on the environmental, social, and economic effects of MAS. It enables users to explore, compare, and interpret evidence across different infrastructure types, ecosystems, and management contexts, supporting transparent and evidence-based decision-making throughout the lifecycle of MAS.
Within VALMAS, ORIES is integrated with the wider modelling and decision-support framework to complement model predictions with empirical evidence and identify areas of agreement, uncertainty, and knowledge gaps. Scenario analyses can be used to explore key questions such as:

- ***What evidence exists for the impacts and benefits of different types of marine artificial structures?***
- ***How do environmental, social, and economic outcomes vary across the construction, operation, and decommissioning phases?***
- ***Where are the key evidence gaps and uncertainties that could influence management decisions?***
- ***Which ecosystem services, habitats, or species are most likely to be affected under different management scenarios?***

HOW ORIES WORKS

Concept: *ORIES collects, organises, and synthesises published evidence on marine artificial structures (MAS), translating it into searchable, comparable summaries. Within VALMAS, the tool has been expanded beyond offshore wind to integrate evidence for oil and gas infrastructure. Users explore evidence through interactive filters and maps to understand which ecosystem components and ecosystem services may be affected, in what direction (positive, negative, no impact or uncertain), and with what level of confidence.*
Inputs: *Peer-reviewed literature and grey literature; spatial layers describing the location and extent of marine artificial structures; and metadata linking infrastructure type, lifecycle phase, and associated pressures to habitats, species, ecosystem services, and socio-economic outcomes.*
System representation: *ORIES uses an ecosystem services framework to connect environmental pressures and ecological responses with changes in the ecosystem services and societal benefits that people value.*
Scenario exploration: *Users can query evidence by infrastructure type (e.g. offshore wind), lifecycle phase (construction, operation, and decommissioning), receptor (e.g. birds, marine mammals, benthic habitats), ecosystem service, pressure, and geographic location to compare likely outcomes, identify trade-offs, and support evidence-based decision-making.*
Uncertainty and assumptions: *ORIES highlights where evidence is robust and where it is sparse, making uncertainties transparent. It identifies knowledge gaps, including areas where ecosystem service relationships remain poorly quantified, and encourages balanced interpretation of the full evidence base rather than focusing solely on negative impacts.*
Future development: *Planned enhancements include expanding coverage to additional marine renewable technologies (e.g. tidal, wave, and floating offshore wind), incorporating new empirical evidence as it becomes available, and strengthening evidence relating to decommissioning and long-term environmental outcomes.*

© VALMAS Project 2025

.

WHY ORIES?

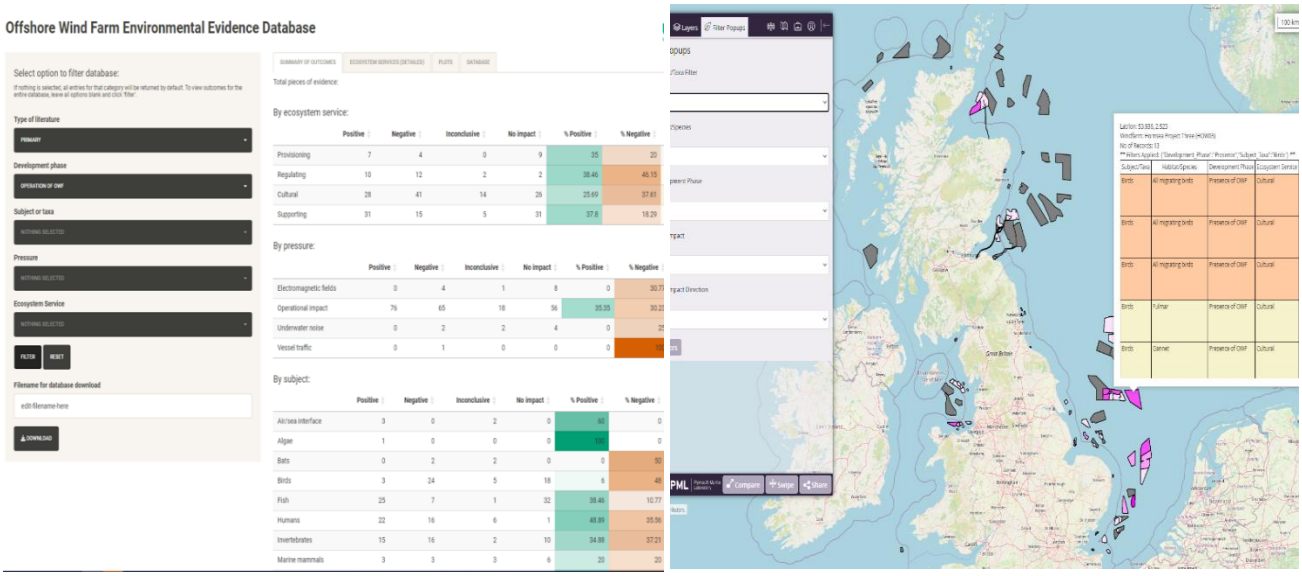


Figure 2. *The ORIES suite of decision-support tools comprising the evidence database (left), which enables users to search and filter published evidence, and the spatial ORIES web-GIS application (right), which visualises the geographic distribution of evidence and marine artificial structures*

Decisions about marine artificial structures often require balancing environmental protection, economic development, and societal benefits. However, the evidence needed to support these decisions is dispersed across hundreds of scientific publications, reports, and datasets, making it difficult to identify relevant information and assess the strength of available evidence. ORIES addresses this challenge by bringing together diverse sources of evidence into a single, searchable platform that enables rapid and transparent access to current knowledge.

Within VALMAS, ORIES provides an evidence base that complements ecosystem modelling and other decision-support tools. By highlighting where evidence is consistent, where uncertainties remain, and where knowledge gaps exist, it helps users compare potential impacts and benefits across different infrastructure types, lifecycle phases, ecosystem components, and ecosystem services. This supports evidence-based marine planning, environmental impact assessment, policy development, and sustainable management of marine artificial structures.

KEY OUTPUTS

ORIES provides a range of evidence products that support transparent and evidence-based decision-making for marine artificial structures (MAS), including:

- Searchable summaries of published evidence from peer-reviewed and grey literature.
- Interactive maps showing the spatial distribution of evidence and marine artificial structures.
- Visualisations of reported environmental, social, and economic impacts across infrastructure types and lifecycle phases.
- Summaries of effects on habitats, species, ecosystem services, and socio-economic outcomes, including the direction of reported impacts (positive, negative, or mixed).
- Indicators of evidence strength, confidence, and knowledge gaps to help identify areas of uncertainty and research priorities.
- Comparative outputs that support evaluation of trade-offs between management options, infrastructure types, and future development scenarios.

© VALMAS Project 2025

Working With Decision Makers and Developers

ORIES was initially developed and refined with 15 different intended end users across two workshops. This including input from the UK offshore wind policy leads (within Defra), the bodies responsible for planning and regulating the use of UK marine space (the Crown Estate and Marine Management Organisation), offshore wind developers (e.g., Orsted, Scottish Power Renewables), conservation agencies and NGOs (e.g. Natural England, Joint Nature Conservation Committee, Blue Marine Foundation), research bodies (e.g., Offshore Renewable Energy Catapult, Centre for Environment, Fisheries Aquaculture Science) and organisations involved in facilitating the transition to net zero (e.g., the Carbon Trust) and the Marine Management Organisation.

REFERENCES

- *Watson, S.C.L, Szostek, C.L., Edwards-Jones, A., Wills, B., Watson, G.J. and Beaumont, N.J., (2025). Assessing, monitoring and mitigating the effects of offshore wind farms on biodiversity. Nature Reviews Biodiversity, 1(9), pp.581-596.*
- *Trifonova, N., Scott, B.E., Watson, S.C.L, Szostek, C., Declerck, M. and Beaumont, N., (2025). Fishing, offshore wind energy, climate change and marine spatial planning: Is it possible to plan for a best use of space?. Ecological Solutions and Evidence, 6(2), p.e70039.*
- *Watson, S.C.L, Somerfield, P.J., Lemasson, A.J., Knights, A.M., Edwards-Jones, A., Nunes, J., Pascoe, C., McNeill, C.L., Schratzberger, M., Thompson, M.S. and Couce, E., (2024). The global impact of offshore wind farms on ecosystem services. Ocean & Coastal Management, 249, p.107023.Edwards-Jones, A. et al. (2024). Stakeholder insights into embedding marine net gain for offshore wind farm planning and delivery. Environmental Challenges, 14, 100814.*
- *Szostek, C.L., Edwards-Jones, A., Beaumont, N.J. and Watson, S.C., (2024). Primary vs grey: A critical evaluation of literature sources used to assess the impacts of offshore wind farms. Environmental Science & Policy, 154, p.103693.*
- *Lemasson, A.J. et al. (2022). Evidence for the effects of decommissioning man-made structures on marine ecosystems globally: a systematic map. Environmental Evidence, 11(1), 35.*

© VALMAS Project 2025

ASPACE

Assisted Spatial Prioritisation Addressing Climate Effects

Website Link [ASPACE WEBSITE]

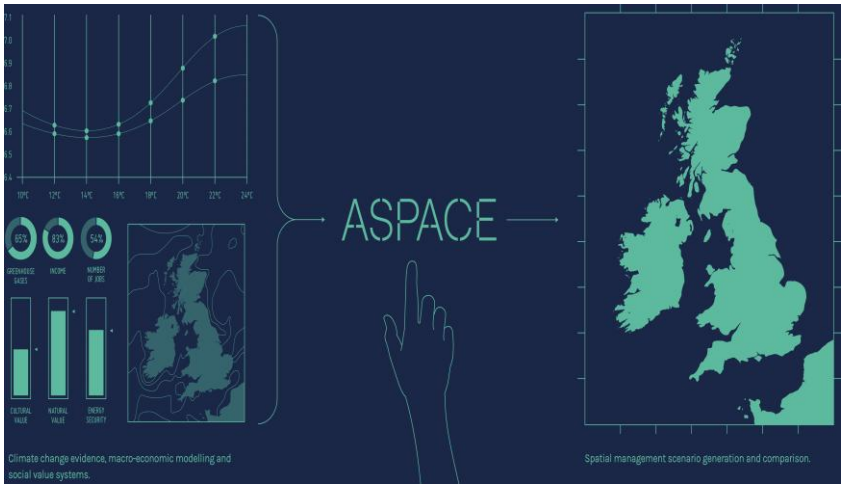


Figure 3 ASPACE online tool

ASPACE (aspace.ac.uk) is an assisted spatial prioritisation software conceived to support the design and exploration of climate-resilient, socially acceptable and economically viable marine spatial management intervention scenarios, such as supporting marine planning, MPA siting and marine industry growth. Specifically, it has been co-developed with UK governments, policy and industry communities, to help practitioners de-risk marine space decisions from climate change, in ways that maximise economic returns for regions of interest, whilst increasing social buy-in for changes in spatial uses. It is specifically geared towards the development of climate change adaptation.

Development of ASPACE is led by Plymouth Marine Laboratory, with support from partners at the University of Essex, University of York and University of Valencia.

AT A GLANCE

Tool Type	*Web application*	**Spatial Scope**	*European marine and coastal waters (applicable across regional and national marine spatial planning contexts)*
Primary Inputs	*Ocean climate model outputs, biodiversity and habitat datasets, socio-economic indicators, marine activity data, stakeholder-defined spatial management scenarios*	**Temporal Scope**	*Present-day baseline with future climate projections to the end of the 21st century*
Primary Outputs	*Interactive maps, climate resilience assessments, scenario comparisons, spatial prioritisation analyses, decision-support metrics, downloadable reports and visualisations*	**Lead VALMAS Contact**	*Dr Elizabeth Talbot sat@pml.ac.uk*

WHAT IS ASPACE?

ASPACE is web-based, free and fully interactive, and can be used in any marine and coastal region of the world where suitable datasets are available. Resulting from a 4 year, UK-based co-developed UKRI research programme and an EU framework programme, with additional support from the private sector, the ASPACE tool is already rich in UK climate modelling, economic and social datasets. Data for other regions of the world is already available too, and users can also upload their own datasets, with

© VALMAS Project 2025

users already engaged across the UK ALBs and industries, as well as across Europe, Africa and South America. Data uploaded by users can be private or shared with the ASPACE user community. As the ASPACE user community expands, our mission is to grow capability to manage our ocean around the world in more sustainable and climate-resilient ways, for future generations

Key Features

- *Interactive web-based decision support system for climate-smart marine spatial planning.*
- *Integrates environmental, ecological, climate and socio-economic datasets within a single platform.*
- *Enables users to compare alternative marine spatial planning and management scenarios.*
- *Provides interactive maps, resilience indicators and decision-support metrics to assess climate impacts.*
- *Supports stakeholder engagement through transparent visualisation of trade-offs and planning outcomes.*

Typical Applications

- *Climate-resilient marine spatial planning and policy development.*
- *Evaluation and comparison of alternative marine management and adaptation scenarios.*
- *Assessment of climate change impacts on marine ecosystems and ecosystem services.*
- *Evidence-based prioritisation of marine conservation, restoration and sustainable blue economy activities.*
- *Stakeholder engagement and decision support for marine governance and environmental management.*

ROLE WITHIN VALMAS

ASPACE serves as the decision-support and spatial scenario analysis platform within VALMAS. It integrates climate projections, ecological, environmental and socio-economic datasets to enable users to assess the impacts of alternative marine management strategies under future climate change. Within the VALMAS project, ASPACE provides the interface for visualising evidence, comparing management scenarios, identifying climate-resilient spatial priorities, and supporting evidence-based marine planning and policy decisions. It translates the scientific outputs generated by VALMAS into an accessible tool for regulators, industry and other stakeholders.

HOW ASPACE WORKS

The ASPACE tool analysis workflow has 4 phases (Figure 3), guidelines for which can be found in the ASPACE user manual, which includes a Quick-start guide (aspace.ac.uk).

Figure 4: *Schematic representation of ASPACE workflow, from ASPACE User Guide v.1.*

Phase 1: Ocean climate modelling, GIS, economic and social data selection from ASPACE platform or user data upload. The user can choose from keeping their uploaded datasets private, or to share them with other ASPACE users. ASPACE has user and privacy policies which can be found in mspace.ac.uk. Additional privacy requirements from users can be requested e.g. by use of additional non-disclosure agreements.

Phase 2: The user initiates the ocean climate modelling analysis, which delivers a classification of the area of interest's climate change vulnerability, based on the user-selected ocean climate modelling datasets. This can be, e.g. for benthic habitats; for

© VALMAS Project 2025

pelagic species of commercial interest; for highly mobile megafauna; or for other nature and ecosystem receptors. The outputs of this phase feed into Phase 3 and can be downloaded as shape files.

Phase 3: The user can create different spatial management scenarios. These analyses include spatial constrains modelling, macro-economic modelling and mapping of scenario effects to stakeholder values.

Phase 4: The user can visualise and compare created scenarios with each other, and with the status-quo (i.e. business as usual, Figure 2A and 2B).

ASPACE is currently freely available online as V1.0 (aspace.ac.uk). ASPACE's development is currently funded at least until 2031, and updates will be communicated to registered users. A new version is already scheduled for launch in early Autumn 2026, which will include updates to the economic model.

WHY ASPACE?

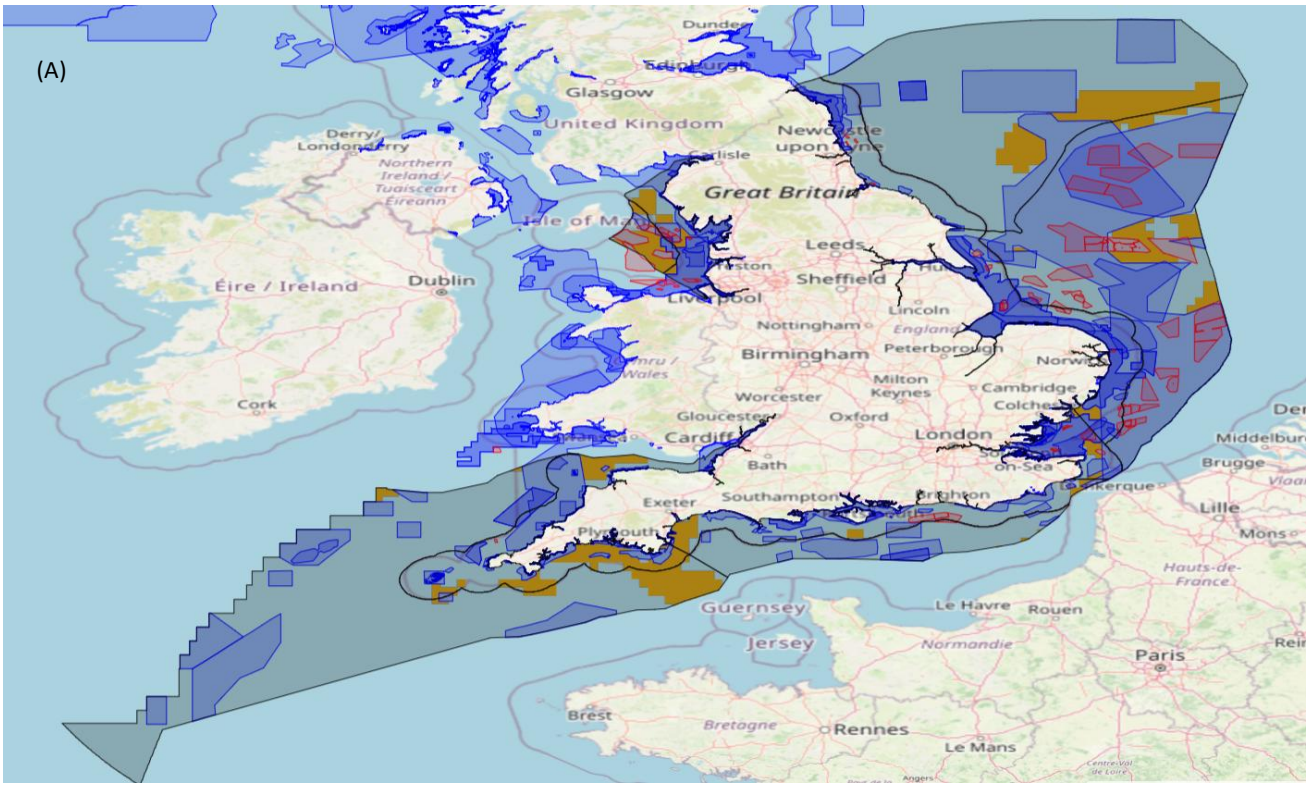
ASPACE advances the state-of-the-art of spatial prioritisation decision-support tools, by providing access to ocean climate modelling analysis power, comprehensive macro-economic modelling and stakeholder values, through a fully interactive and easy to use front-end, supported by lay-person language documentation. This represents a significant advance in technology transfer between academia and practice, in support of real life-evidence based decision making around marine space. These unique features equip Marine Planners and others interested in marine space, for the first time, with the ability to create and explore different spatial management intervention scenarios – for instance, where to place compensatory measures, where to develop wind, where to site MPAs – the potential impacts of which are then estimated and compared based on their projected climate-resilience, their degree of alignment with stakeholder values, and what their effects are on the adjacent blue economy of the region of interest. This allows ASPACE users to understand the climate, economic and social dimensions of marine space management decisions, helping meet significant capacity gaps in the practice, and supporting a more resilient future for nature and people. ASPACE supported the development of a Roadmap for climate-smart Marine Spatial Planning in the UK Overseas Territories; it is also currently under consideration as potential support infrastructure for the Crown Estate. ASPACE is already supporting capacity building in MSP elsewhere: in South Africa, via the International Platform on Ocean Sustainability; and in South America and the Caribbean Region via the activities of the Marine Spatial Planning Task Team of UNESCO IOC (IOCARIBE).

KEY OUTPUTS

The main outputs of ASPACE are spatial maps that provide solutions for spatial scenario questions created by users, along with estimates of their climate resilience, economic effects and alignment with the values of surveyed stakeholders. All mapped data can be exported by users as spatial data files, and all criteria estimates for user generated scenarios are downloadable as excel files.

© VALMAS Project 2025

(A)



(B)

Comparison

Metric	SO277 Increase MPA network by 4% into climate-resilient benthic sites avoiding wind	SO276 Increase MPA network in climate-resilient sites by 20% avoiding wind	SO275 Expanding MPA network in climate-resilient benthic sites by 30% in England avoiding wind	SO274 Area of climate-resilient UK MPA network in near future
General				
ASMS Type	single_sector	single_sector	multiple_sector	existing_climate_resilience
Case Study Site	uk_case_study	uk_case_study	uk_case_study	--
Climate				
Desired (%)	4	20	30	--
Tolerance (%)	2	5	5	--
Within tolerance bounds?	Yes	No	No	--
Optimised (%)	3.98	4.64	4.64	--
Optimised additional (km²)	17,000.0	19,700.0	19,700.0	--
Required additional (km²)	17,000.0	85,200.0	128,000.0	--
Lower limit (km²)	16,700.0	80,900.0	121,000.0	--
Upper limit (km²)	17,400.0	89,400.0	134,000.0	--
Greenhouse Gas Emissions - ASMS (Thousands of Tonnes)	936.0	935.0	935.0	N/A
Greenhouse Gas Emissions - BAU (Thousands of Tonnes)	947.0	947.0	947.0	N/A
Greenhouse Gas Emissions - Change (Thousands of Tonnes)	11.0	12.0	12.0	N/A
Economic				
Gross Value Added - ASMS (£M)	1300.0	1300.0	1300.0	N/A
Gross Value Added - BAU (£M)	1310.0	1310.0	1310.0	N/A
Gross Value Added - Change (£M)	10.0	10.0	10.0	N/A
Labour Compensation - ASMS (£M)	734.0	734.0	734.0	N/A
Labour Compensation - BAU (£M)	739.0	739.0	739.0	N/A
Labour Compensation - Change (£M)	5.0	5.0	5.0	N/A
Number of People Employed - ASMS	21000.0	21000.0	21000.0	N/A
Number of People Employed - BAU	21200.0	21200.0	21200.0	N/A
Number of People Employed - Change	200.0	200.0	200.0	N/A
Social				
Social Scoring - ASMS	0.091	0.091	0.091	N/A
Social Scoring - BAU	0	0	0	N/A

Figure 5: *In this example, we explored a spatial management question focused on compensatory measures "Where could the MPA network (blue) be expanded into within English Waters (black), to protect climate-resilient benthic habitats (yellow), whilst enabling the construction of all existing wind licenses (red)?". A) Output map highlighting in yellow areas within English waters adjacent to currently designated sites, where benthic habitats are climate-resilient under moderate emissions (RCP4.5) between now and 2045. B) Scenario criteria estimates table (one scenario per column) comparing climate-related, economic and social metrics between the current distribution of marine sectors (business-as-usual, "BAU") and different alternative spatial management scenarios (ASMS). Specifically, we asked the tool expand the MPA network by 4% (left), 20% (second from left) or 30% (second from right) into climate-resilient benthic habitats adjacent to currently designated sites in English waters, avoiding current wind leases. Estimates for the BAU on the right.*

© VALMAS Project 2025

Working With Decision Makers And Developers

ASPACE has been developed through close collaboration between marine scientists, software developers, policymakers and end users to ensure that it meets the needs of real-world marine spatial planning. The platform enables decision makers to explore and compare alternative management scenarios using robust scientific evidence presented through intuitive maps, visualisations and decision-support metrics. By integrating stakeholder input with environmental, ecological and socio-economic data, ASPACE promotes transparent, collaborative and evidence-based decision making, helping bridge the gap between scientific research and practical marine management.

REFERENCES

1. Queirós, A.M., et al., *Early Warning System: Climate-smart spatial management of UK fisheries, aquaculture and conservation. A report of the NERC/ESRC Marine Spatial Planning Adressing Climate Effects project.* . 2024.

2. Queirós, A.M., et al., *Bright spots as climate-smart marine spatial planning tools for conservation and blue growth.* Global Change Biology, 2021. **27**(21): p. 5514-5531.

3. Talbot, E., et al., *East Marine Plan Storyline: Narrative of marine (spatial) planning scenarios explored in the MSPACE project.* 2025. https://doi.org/10.5281/zenodo.18173837

© VALMAS Project 2025

StrathE2E web application

An end-to-end food web model simulating the flow of nutrients through the full marine ecosystem

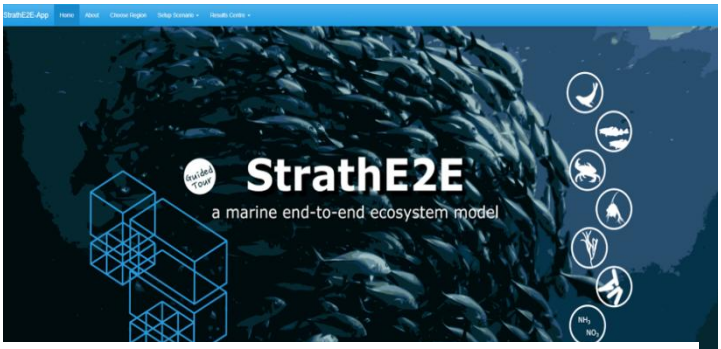


***Figure 6**: StrathE2E web application*

Website Link
https://rshiny.science.strath.ac.uk/apps/StrathE2EApp/

StrathE2E was developed at the University of Strathclyde, with the R package first published in 2021[1]

University of Strathclyde Glasgow

The StrathE2E Web-app is an interactive, user-friendly, web-interface to the StrathE2E end-to-end ecosystem model. StrathE2E is used to simulate the big-picture "what-if" scenarios and trade-offs for marine ecosystem management.

AT A GLANCE

Tool Type	*Web application*	**Spatial Scope**	*Regional shelf sea ecosystem (spatially aggregated; configurable for different shelf sea regions such as the North Sea and NW European shelf seas)*
Primary Inputs	*Sediment maps and bathymetry data, ocean temperatures, riverine and atmospheric nutrient delivery, nutrient, detritus, and plankton concentrations at ocean boundaries, as well as exchanges of water masses. Fisheries data including activity rates, landings, bycatch, and discards. Target observations for model fitting.*	**Temporal Scope**	*Decadal simulations, including historical reconstructions and future climate scenario projections (e.g. 2010s–2090s)*
Primary Outputs	*Time series of ecosystem biomass, nutrient and carbon fluxes, fisheries yields, trophic cascade responses, ecosystem indicators, and scenario comparisons for climate and management option*	**Lead VALMAS Contact**	*Prof Michael Heath – m.heath@strath.ac.uk ; Dr Jack Laverick – jack.laverick@strath.ac.uk*

WHAT IS THE StrathE2E Web Application?

The StrathE2E Web-app is an interactive, user-friendly, web-interface that can be used to explore the effect of scenarios on marine ecosystem, such as climate change, fishing effort, discarding, sea-bed abrasion, nutrient inputs, and other lethal/sublethal effects which could be linked to pollution or marine artificial structures. The app allows users to run simulations for modelled regions throughout the Atlantic and Arctic. No coding experience is required, and the results of any experiments can be downloaded for future use.

© VALMAS Project 2025

Key Features

- *Interactive web interface for configuring, running and visualising StrathE2E ecosystem model simulations.*
- *Enables rapid comparison of management and climate change scenarios through dynamic plots and ecosystem indicators.*
- *Provides intuitive visualisation of food web dynamics, nutrient cycling, fisheries and top predator responses across regional shelf sea ecosystems.*
- *Allows users to explore model outputs without requiring specialist modelling expertise or local software installation.*

Typical Applications

- *Exploring ecosystem responses to alternative fisheries management and marine policy scenarios.*
- *Comparing projected impacts of climate change on marine food webs and ecosystem functioning.*
- *Assessing potential ecosystem-wide consequences of offshore wind farms and other marine developments.*
- *Supporting research, stakeholder engagement and evidence-based marine management through accessible scenario exploration and visualisation.*

ROLE WITHIN VALMAS

The StrathE2E Web Application provides an accessible interface for exploring the outputs of the StrathE2E end-to-end ecosystem model within VALMAS. It enables users to investigate how climate change, fisheries management and offshore renewable energy scenarios influence marine food webs, ecosystem functioning and key ecosystem indicators. By translating complex model simulations into interactive visualisations and scenario comparisons, the application supports evidence-based decision making, facilitates stakeholder engagement, and helps communicate the ecosystem-wide consequences of alternative marine management strategies.

WHY StrathE2E?

The StrathE2E Web-app was built as a tool to improve the accessibility of the modelling process and improve ocean literacy. StrathE2E was designed to be a model which runs very quickly. This allows users to model in a "conversational way", asking questions and receiving answers promptly, to help form the next question. Our app can therefore be used in a workshop setting to explore management options with a diversity of stakeholders, or for educational activities. Crucially, the app provides agency to stakeholders, allowing them to explore the system themselves and evaluate management options with reduced dependence on modelling experts.

HOW StrathE2E WORKS

The StrathE2E Web-app links to the StrathE2E model, which is run in real-time on a server in Strathclyde. When a scenario is built and run in the app a new set of results are generated in Scotland to display on your screen. For more information on how StrathE2E works, and what it does, see the model-specific factsheet.

Only a subset of scenarios can be specified, and outputs viewed, through the web-app. For full functionality users should use the R package to code their own analyses (https://www.marineresourcemodelling.maths.strath.ac.uk/strathe2e/index.html). Future developments plan to increase what is accessible to app users. This includes more ecosystem services outputs, and a screening tool for searching through a set of pre-evaluated scenarios.

© VALMAS Project 2025

KEY OUTPUTS

Figure 7 *The StrathE2E Web-app*

The StrathE2E Web-app primarily shows the differences between a baseline case and a modelled scenario. These can be changes in the biomasses of food web components, or changes in fishing outcomes (including landings and discards of different parts of the food web by different fishing fleets).

These outputs can be used to evaluate possible management strategies against indicators of interest: “Does banning discarding by fisheries boost fish biomass?”, “Does reducing fishing offset climate impacts?”. The results of simulations are accessible, and downloadable, from the “Results Centre” tab.

Working With Decision Makers And Developers

The StrathE2E Web Application has been developed to support collaboration between scientists, policymakers, regulators and offshore industry stakeholders by providing an accessible interface for exploring ecosystem model outputs. The StrathE2E web-application has been used in collaborative scenario development with the fishing industry, offshore renewable energy developers and statutory bodies to assess trade-offs between offshore wind development, fisheries and climate change. By presenting complex ecosystem responses through interactive visualisations and scenario comparisons, the application helps translate scientific evidence into practical insights for marine spatial planning and sustainable offshore energy management.

REFERENCES

1. *Heath, M.R., Speirs, D.C., Thurlbeck, I. and Wilson, R.J., 2021. StrathE2E2: an R package for modelling the dynamics of marine food webs and fisheries. Methods in Ecology and Evolution, 12(2), pp.280-287.*

2. *Heath, M.R., Speirs, D.C. and Somerfield, P.J., 2014. Cascading ecological effects of eliminating fishery discards. Nature Communications, 5, p.3893*

3. *Laverick, J.H., Speirs, D.C. and Heath, M.R., 2025. Sea-Ice Retreat From the Northeast Greenland Continental Shelf Triggers a Marine Trophic Cascade. Global Change Biology, 31(4), p.e70189.*

4. *Heath, M., 2025. Compensatory measures for offshore wind farm impacts on seabirds: sensitivity of seabird biomass in the StrathE2E marine ecosystem model. ECOWINGS Topic Sheet 01. ECOWind Programme. Available at: https://ecowind.uk/wp-content/uploads/2025/04/ECOWINGS_TopicSheet01_FINAL.pdf*

5. https://www.marineresourcemodelling.maths.strath.ac.uk/strathe2e/index.html (link to R package).

© VALMAS Project 2025

Acronym List

Acronym	Definition
VALMAS	Valuing Marine Artificial Structures
MAS	Marine Artificial Structures
DST	Decision Support Tool
ORIES	Offshore Renewable Impacts on Ecosystem Services
ASPACE	Assisted Spatial Prioritisation Addressing Climate Effects
PML	Plymouth Marine Laboratory
UKERC	UK Energy Research Centre
GIS	Geographic Information System
R Shiny	R package for developing interactive web applications
MPA	Marine Protected Area
MSP	Marine Spatial Planning
UKRI	UK Research and Innovation
EU	European Union
ALB	Arm's-Length Body
UNESCO IOC	United Nations Educational, Scientific and Cultural Organization – Intergovernmental Oceanographic Commission
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
BAU	Business as Usual
ASMS	Alternative Spatial Management Scenarios
RCP	Representative Concentration Pathway (greenhouse gas emissions scenario)
StrathE2E	Strathclyde End-to-End marine ecosystem model
VALMAS	Valuing Marine Artificial Structures

© VALMAS Project 2025