ICES Journal of Marine Science, 2025, Vol. 82, Issue 5, fsaf059
https://doi.org/10.1093/icesjms/fsaf059
Received: 30 December 2024; **revised:** 24 March 2025; **accepted:** 24 March 2025
Quo Vadimus

Shaping the future of marine socio-ecological systems science: combining interdisciplinary and transdisciplinary approaches and knowledge co-creation with diverse stakeholders

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Abstract

Following the first symposium held in Brest, France, in 2016, the second Marine Socio-Ecological Systems Symposium (MSEAS) was held in Yokohama, Japan, in 2024, after 4 years of postponement due to the COVID-19 pandemic. In 2016, interdisciplinary efforts to inform ocean governance using the Social-Ecological System (SES) approach was highlighted as highly necessary. MSEAS 2024 emphasized the combination of interdisciplinary and transdisciplinary approaches, exploring and developing new insights in co-designing research and co-producing solution-oriented knowledge, while involving diverse teams and stakeholders. The symposium covered a range of topics, including methods and assessment strategies of how to interpret social–ecological systems, stakeholder perceptions and how to communicate the research, involvement of communities, and the co-creation of science. Additionally, the symposium featured inspirational events for Early Career Ocean Professionals (ECOPs) and explored art–science connections. This graphical record aims to convey the essence of the symposium to a broad audience through illustrations. These graphics by a Japanese illustrator are the result of a participatory process during the conference, based on interviews with session conveners and contributions from participants via an online form.

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Abstract

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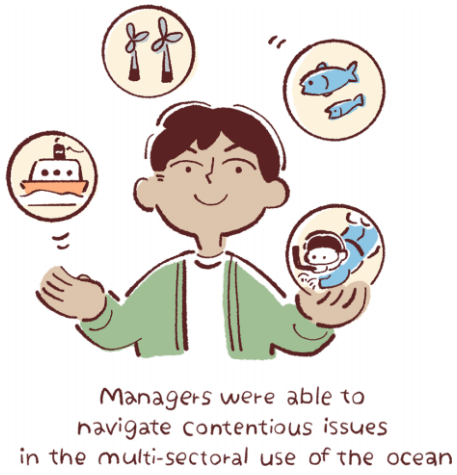
The challenge within sustainable use of the marine environment is to enable growth in the blue economy, and the associated development of coastal livelihoods,

while equally supporting sustainable social, economic and environmental outcomes.

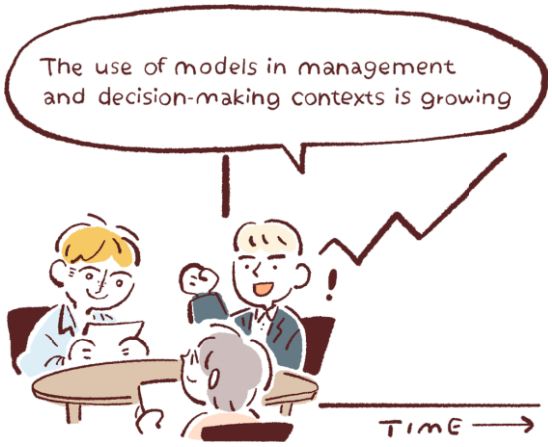
This challenge explicitly involves managing human impacts on the earth's marine and coastal systems, and managing the feedback of these impacts on coastal communities, industries, stakeholders, and society in general.

The second Marine Socio-Ecological Systems Symposium (MSEAS) covered a range of topics including methods and assessment strategies of how to interpret social-ecological systems, stakeholder perceptions and how to communicate the research, involvement of communities and the co-creation of science, as well as inspirational events for Early Career Ocean Professionals (ECOPs) and art-science connections (2nd Marine Socio-Ecological Systems Symposium website, 2024).

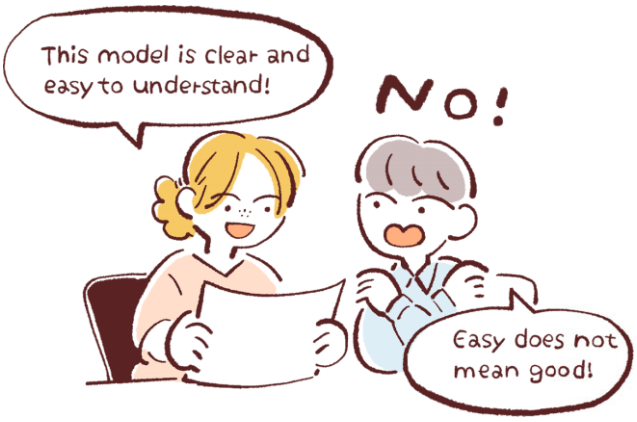
During the symposium there were discussions on how to interpret marine ecosystems, for example through modelling....



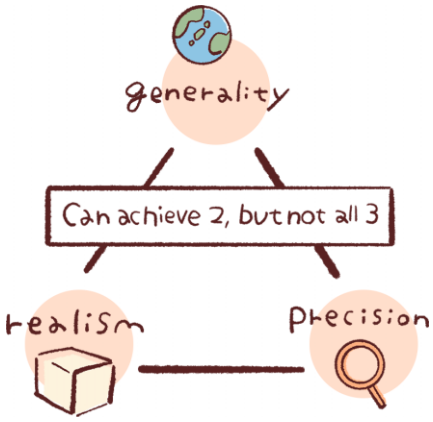
The theoretical benefits of coupled modelling are finally coming to fruition.



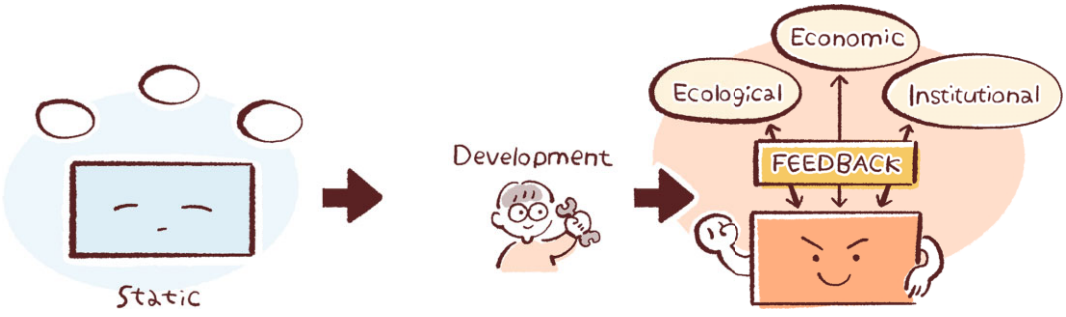
We need to ensure models are operational, not just for theoretical research - we need to engage stakeholder and management institutions early and often.



Fitting data to conceptual models needs to be well-thought out and theoretically well-considered.

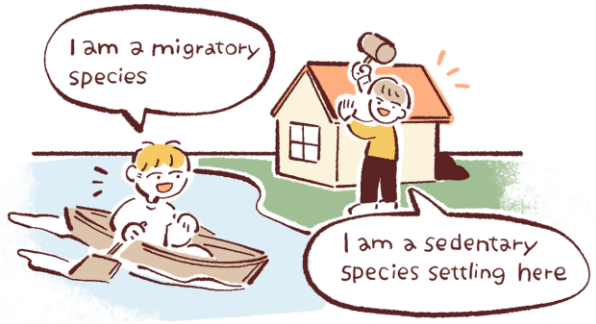


But we need to keep in mind the trade-offs among modeling choices.



We need to develop dynamic models with full system feedback to allow for a more realistic assessment of trade-offs in SES.

...how to map the marine systems using, for example, GIS....

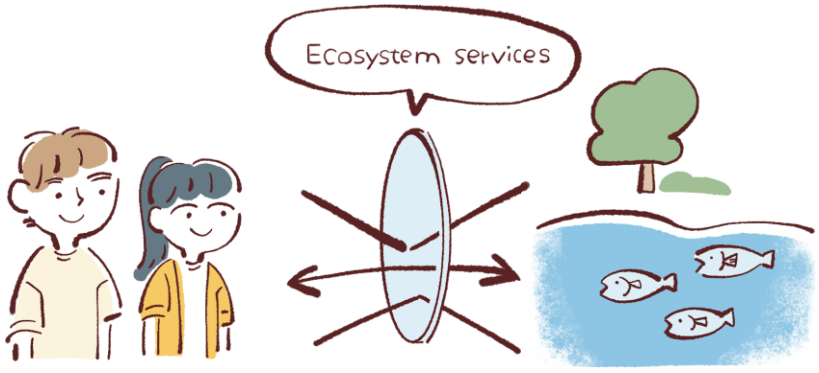


Humans move through spaces, attach to places, and exist in conflict in shared spaces.

Different values, priorities, and desired outcomes can lead to conflicts between managers and others.

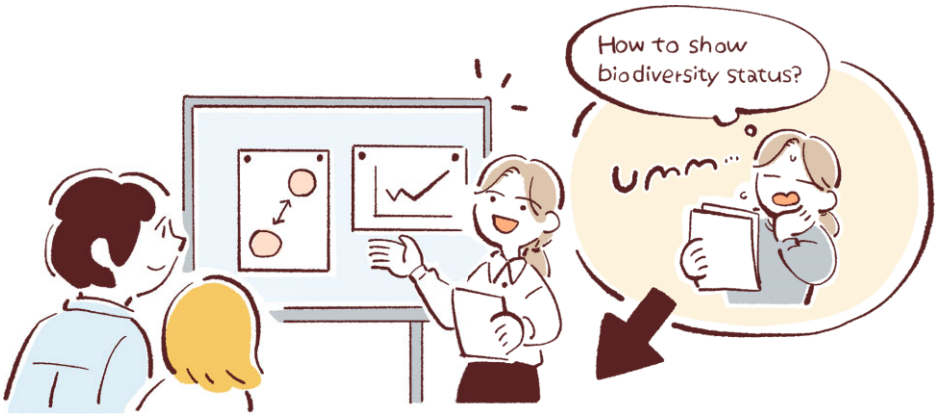
Studies which map human dimensions onto seascapes can provide insights into how people navigate shared space and plan for the future, in addition to documenting spatial uses in marine socio-ecological systems.

...how to interpret the marine environment using the concept of ecosystem services.



Ecosystem services provide a lens linking ecosystem state and human well-being. They serve as an effective way to incorporate the human dimension into the assessment of ecosystem states at various spatial scales (global, regional, local), enabling research related to diverse topics such as ecosystem/biodiversity indicators, Marine Protected Areas, and stakeholder engagement.

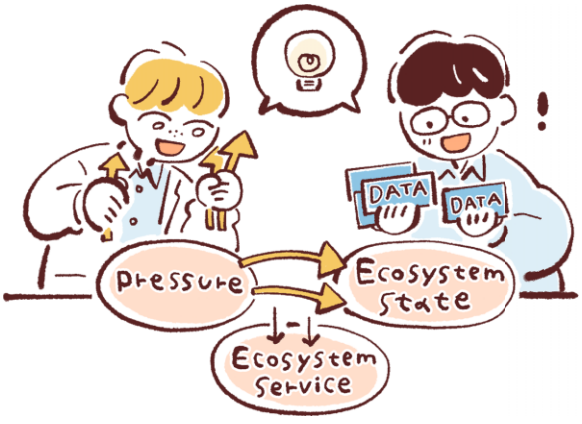
We discussed how to measure the marine environment using indicators...



Researchers struggle to set thresholds for marine ecosystem assessment that serve as decision criteria – most indicators only describe biodiversity change rather than its status in marine ecosystems.

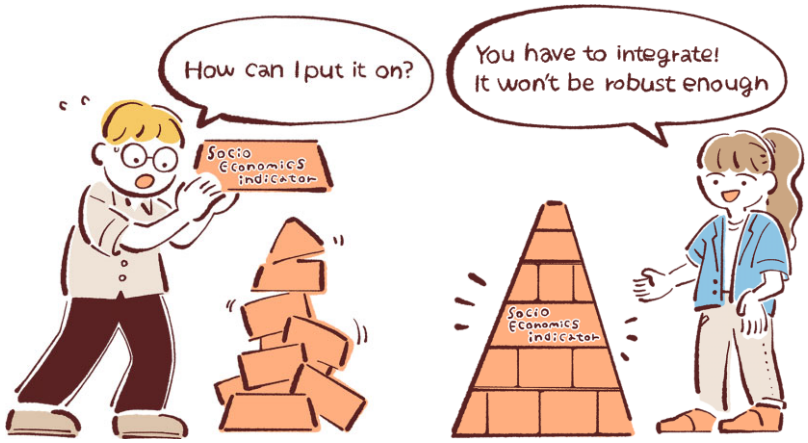
One major challenge is the lack of dedicated data to assess marine ecosystems, which forces us to rely on opportunistic data and brings several limitations.

Furthermore, integrating different indicators remains difficult, and in some cases may be impossible.

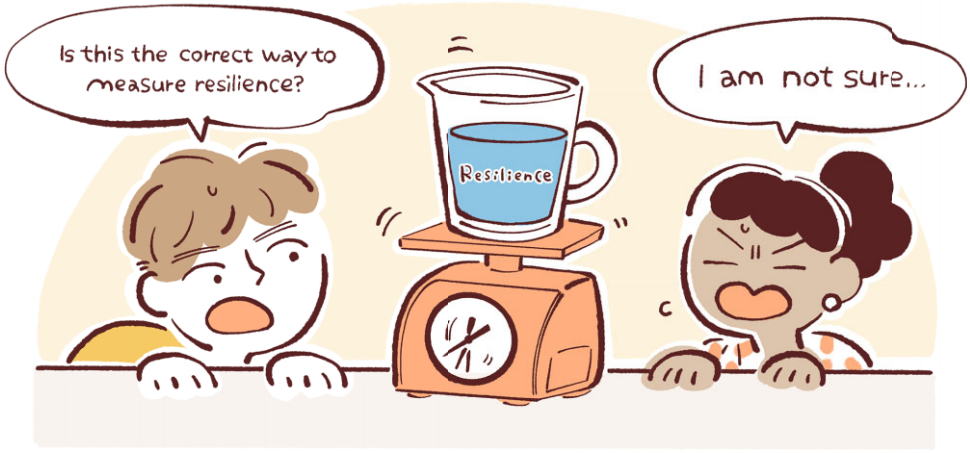


Nevertheless, we are making progress in understanding pressure-state relationships, and in some cases, we can now show links between ecosystem state, pressures, and ecosystem services.

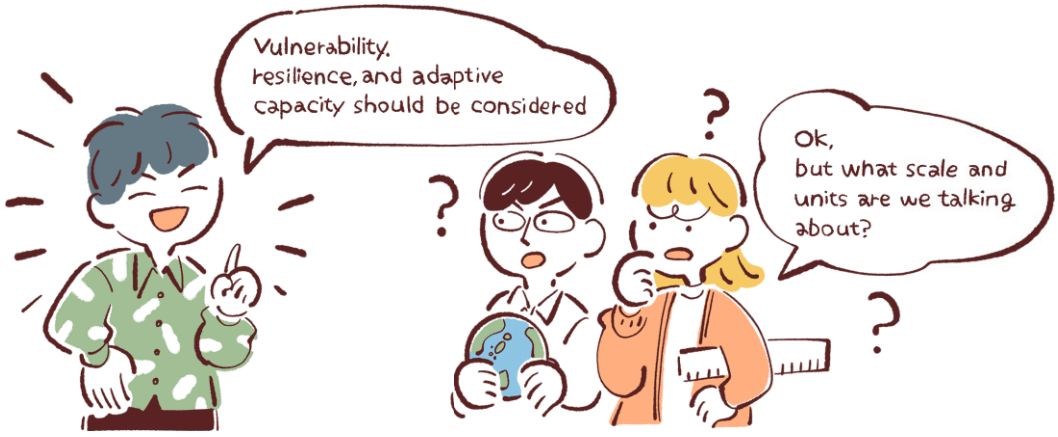
...including more social indicators.



We need to develop and include social indicators to understand change. Social scientists need to work at the same level of detail and robustness as natural scientists so we don't end up being the "added extra" at the end of an environmental modelling process.

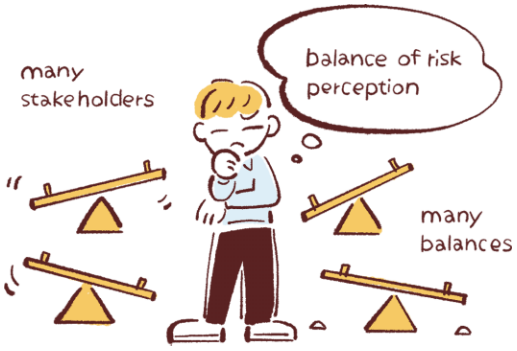


We haven't yet reached standardized methods to assess SES resilience.

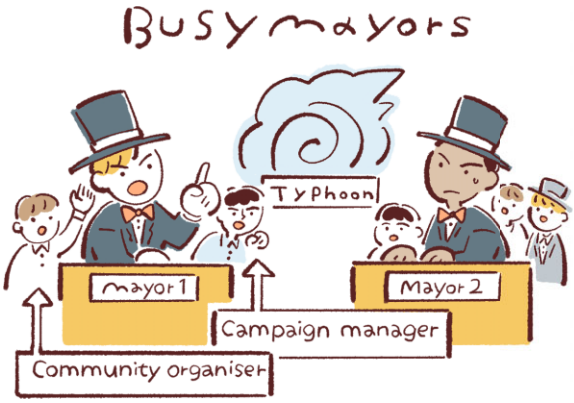


The way of assessing vulnerability, resilience, and adaptive capacity of SES dependent on which factors they study or which scale they work on.

The symposium discussed what happens to our science after it is produced, diving into topics such as how risk is perceived by stakeholders...

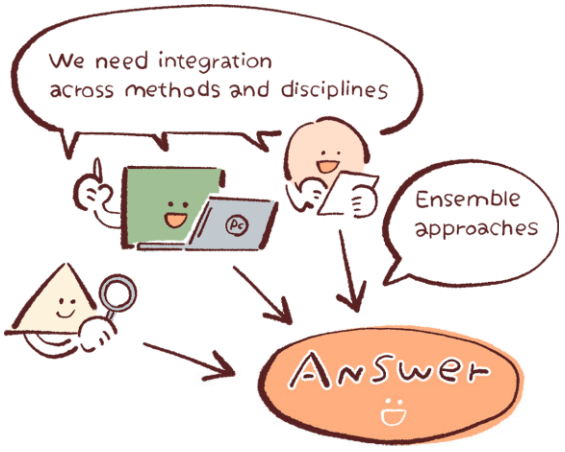


Politicians need to balance differing values and priorities around risk: public perception of risk can differ significantly from research and technical advice.



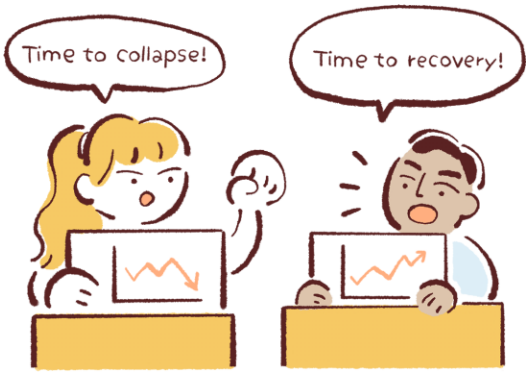
Games are a great way to represent social dynamics in decision-making processes.

There is a lot of information available but we are not acting fast enough - we need to stop only talking and instead act to implement and operationalize our risk assessments.



Both multiple tools and multiple disciplines will help answer the same question in different ways. This will help identify tradeoffs and make these explicit.

Uncertainty needs to be clearly communicated, including differences in risk perception. Otherwise, we are making an assumption about how stakeholders perceive risk.

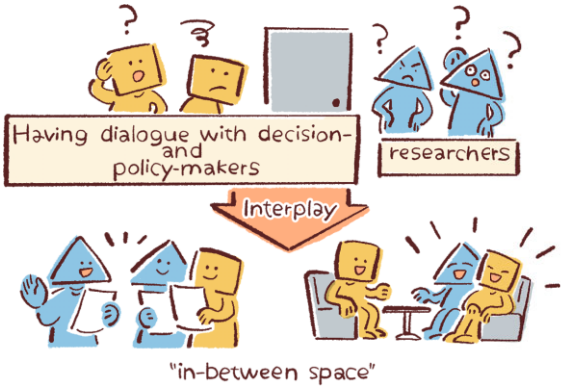


Regardless, we need to consider risk and not be paralyzed by it. We discussed about how to talk about risk - how should we frame it to persuade or galvanise action.

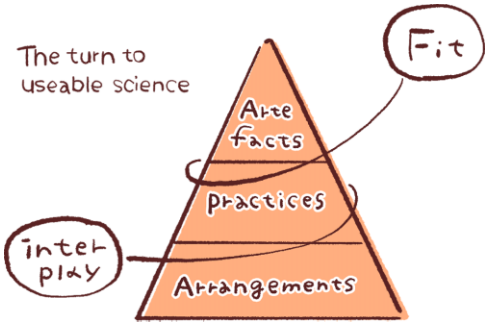
... as well as an in-depth session on how our interdisciplinarity can be harnessed to communicate our recommendations to policy makers.

What gifts do you bring from your discipline? Interdisciplinarity and pluralism were key themes throughout the Symposium; i.e. not trying to argue with each other but acknowledging how different disciplines contribute to a complex yet coherent understanding of the oceans.

By being more encompassing, we are adding more complexity to the solution space - it creates additional challenges for collaborations among researchers, practitioners and policymakers, but this is something we need to work towards accomplishing.



Having dialogue with decision- and policy-makers is key for researchers to understand how to make their research useful. There is a need for "interplay" - generating a weakly institutionalized "in-between space" in which researchers and policymakers interact to find more inclusive ways of tackling complex challenges.

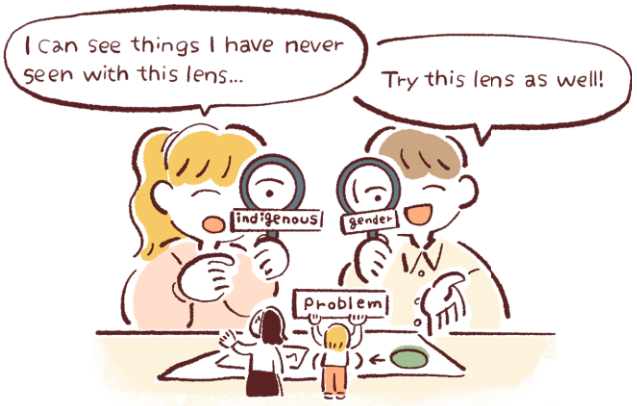


We can look at the knowledge production system as a set of Arrangements, Practices and Artefacts. We need to improve our practices and artefacts through the enabling conditions of improving the "fit" of artefacts and the development of "interplay" practices.

Saying something is only half of communicating - we need to use the correct artefacts to get our message across. Useability (relevant, credible, legitimate research) can be increased through proven strategies!

By bringing coastal communities into the discussion, we were better able to improve our understanding of impacts and trade-offs and therefore improve decision-making.

Some presentations explored inspiring achievements of coastal communities in problem-solving, under a changing environment.

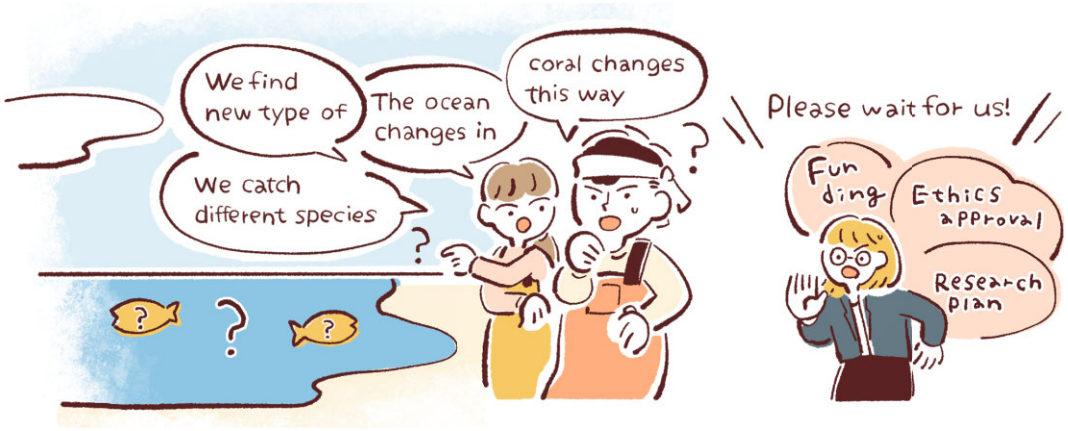


Different lenses can change the way we see the world –for example, an indigenous lens has the role of sharing stories and techniques that emerge from diverse cultural context, while a gender lens can make visible underrepresented stakeholders and their knowledge and contributions.

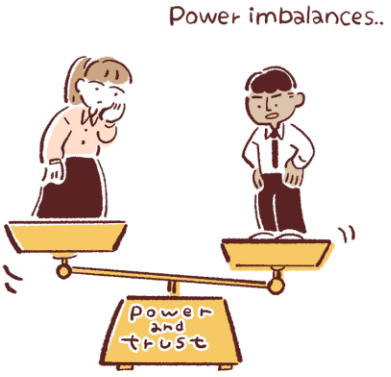
There is still a need to bridge our local and culturally-case specific work with these big modelling enterprises and generalizing critical concepts such as Blue Economy.

Involvement in citizen science projects has led to changes in local communities as well. Communities use knowledge systems, generate their own, or draw from studies to understand change by interacting with scientists. In this way, they are creating a space to make changes in the world of science.

And by bringing local communities into the science process, we are able to co-create knowledge and solutions.



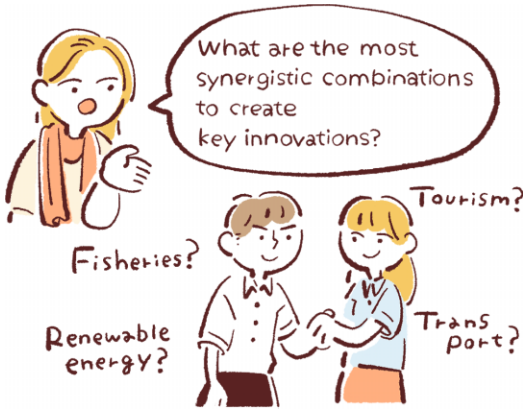
Addressing the challenges of rapid ecological changes increasingly requires the co-creation of knowledge with resource users and communities. Sometimes knowledge of such local stakeholders can capture on-the-ground realities faster than traditional scientific methods.



In knowledge co-creation, power imbalances between stakeholders should be avoided.

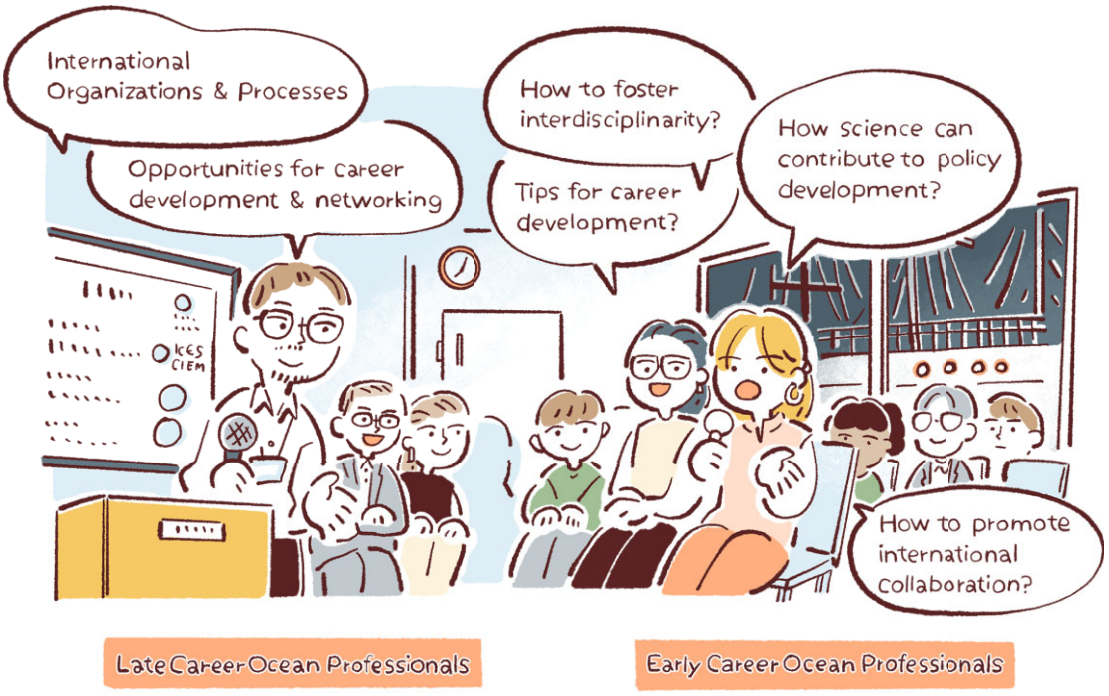
Trust building is also crucial for successful knowledge co-creation, though challenging in short-term projects.

Knowledge co-creation also applies to policymakers and researchers from different disciplines, not just researchers and local communities.

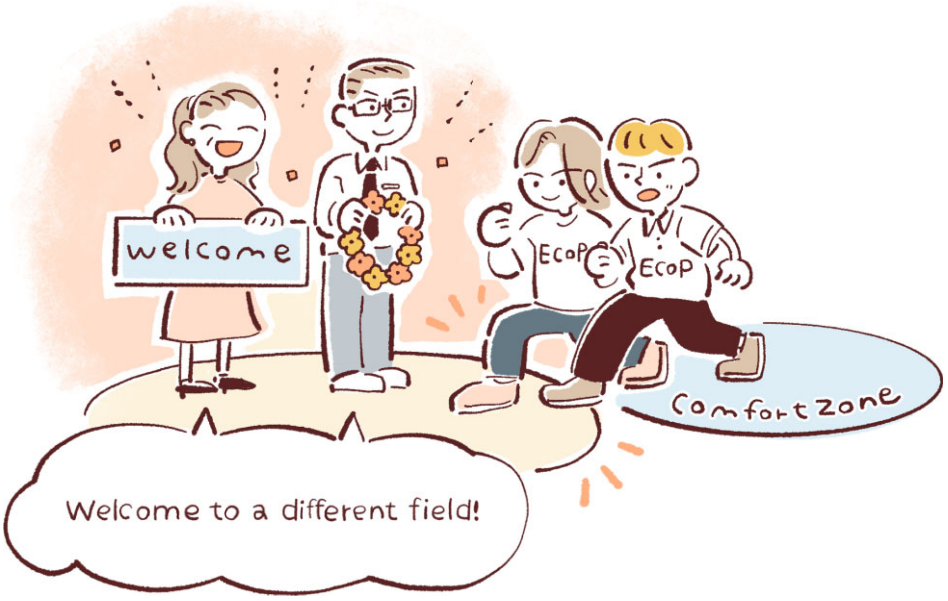


Furthermore, consideration of the most conflicting/synergistic combination of industries and stakeholders could provide a key insight in driving progress towards sustainable ocean development.

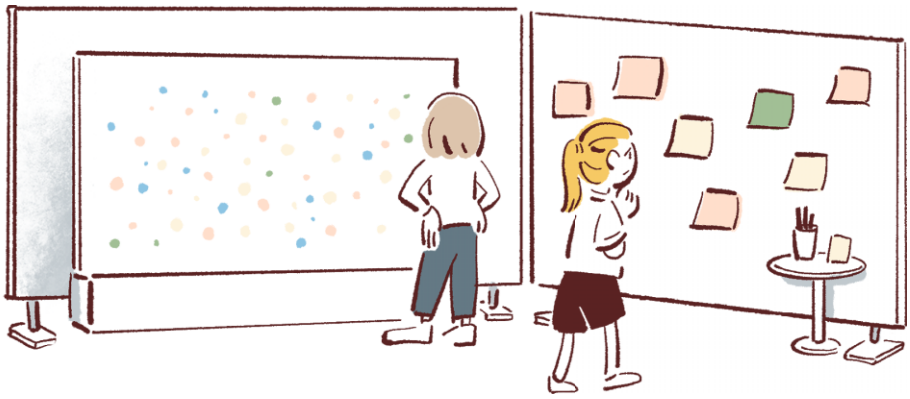
Another highlight of the MSEAS was the side event for Early Career Ocean Professionals (ECOPs)



ECOP comprised 53% of the participants (106 out of 201) through out the symposium.
At the side event, ECOPs received explanations about international organizations and processes, and engaged in discussions regarding several themes.

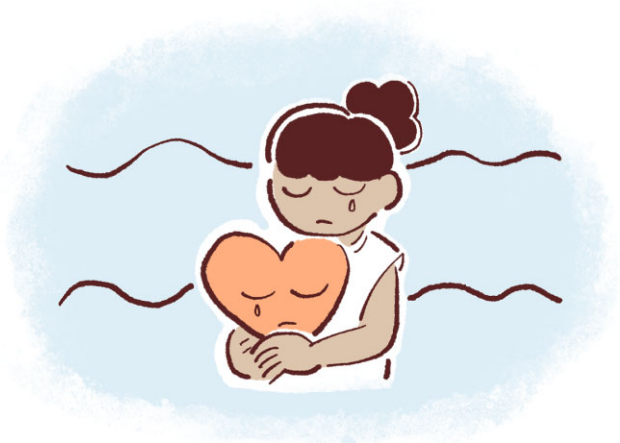


One of the key takeaway was "to be brave enough to step out of your comfort zone" both in one's career and disciplinary work, for future research activities and career development of ECOPs. Yet there was a need to be mindful of ECOPs' common experience of short term positions or position uncertainty which could influence their ability to take these next steps.



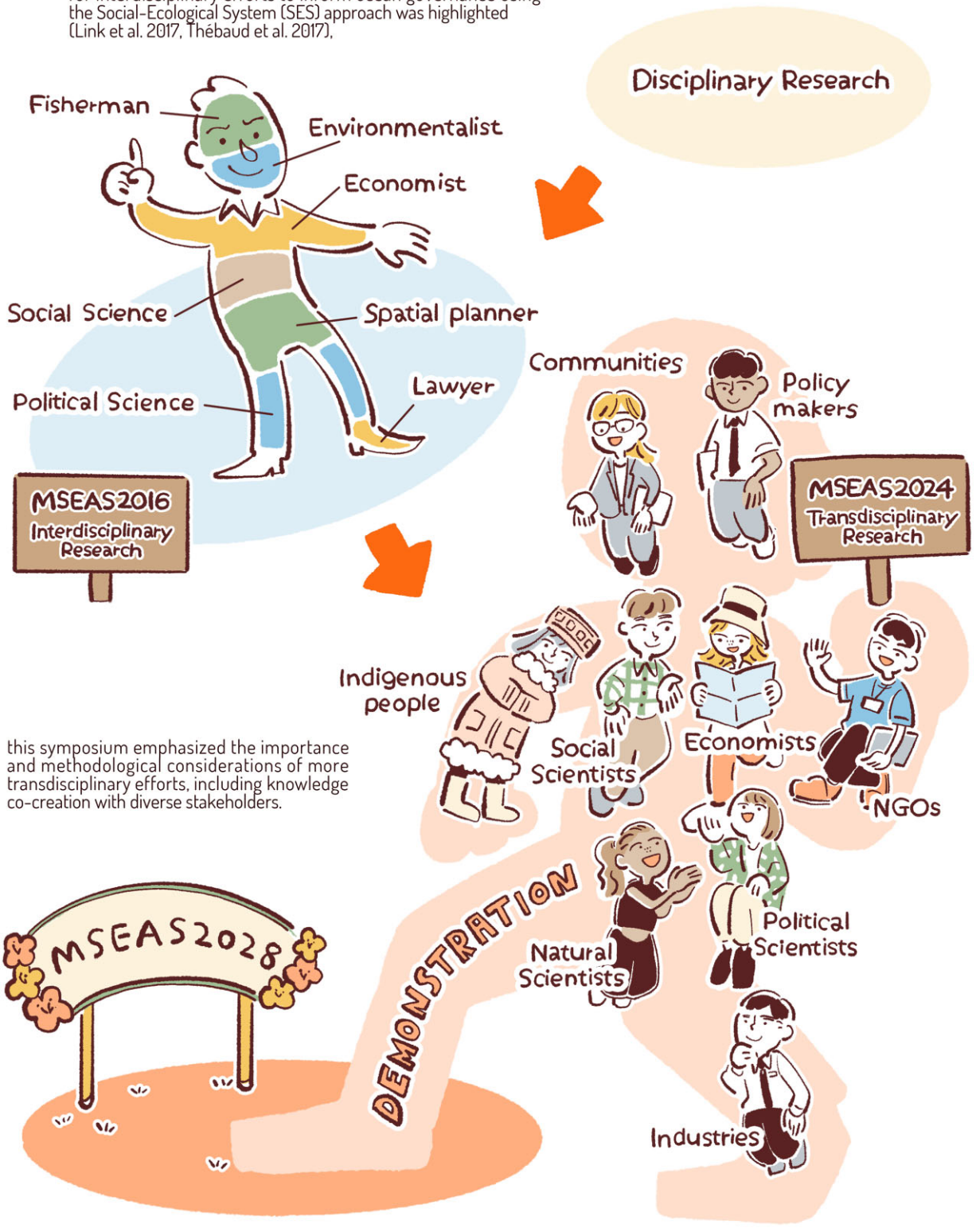
Furthermore, an event by the initiative "Art for MOTHER OCEAN," which fosters the connection between science and art was held. Participants enjoyed an exhibition of art pieces inspired by the ocean,

and gained a valuable opportunity to reconnect with the ocean through Zen, traditional Japanese dance, and collaborative art creation.



It also allowed us to acknowledge our emotions – good and bad – associated with the environment, including eco-grief.

Following the 2016 Brest symposium, where the high necessity for interdisciplinary efforts to inform ocean governance using the Social-Ecological System (SES) approach was highlighted (Link et al. 2017, Thébaud et al. 2017),



this symposium emphasized the importance and methodological considerations of more transdisciplinary efforts, including knowledge co-creation with diverse stakeholders.

We hope that at MSEAS 2028, these advances will be demonstrated, and the implications for a sustainable ocean will be showcased.

Acknowledgements

We would like to express our gratitude to all participants and session conveners of MSEAS 2024 for their valuable feedback, which contributed to the creation of this graphical record through a participatory process. We acknowledge the plenary presentation for Session 2 given by Emily Ogier, entitled "Taking stock: how are interdisciplinary research and cross-sectoral approaches serving marine governance? Vignettes and provocations from southern waters" from which we gained inspiration for the illustration on Arrangements, Practices, and Artefacts on page 9. We also acknowledge Bas Kohler for his outstanding work and for the remarkable contribution of his illustration, which reflects discussions from MSEAS 2016, and is referenced on the top left of page 14. We are also deeply grateful to Benjamin Blanz, a participant who has provided the original idea for the illustration summarizing MSEAS 2024 on page 14. We extend our sincere gratitude to the three anonymous reviewers for their thoughtful feedback, which significantly improved the content of our manuscript. We are also grateful to the Editor-in-Chief for welcoming our approach of using graphical records and his kind support in bringing this manuscript to publication.

Supplementary data

Supplementary data is available at *ICES Journal of Marine Science* online.

Conflict of interest: None declared.

Funding

None declared.

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Handling Editor: Howard Browman