Institution: University of Aberdeen

Unit of Assessment: 7 (Earth Systems and Environmental Sciences)

Title of case study: Applying an Ecosystems approach to Stakeholder Engagement in Marine Spatial Planning

Period when the underpinning research was undertaken: 2014-2019

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Beth Scott	Professor in Biological Sciences	2006-present
Tavis Potts	Reader in Environmental Geography	2014-present
Anne-Michelle Slater	Senior Lecturer in Law	01/1996-present

Period when the claimed impact occurred: 2015-2020

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact (indicative maximum 100 words)

Interdisciplinary research across ecological, social sciences and law at the University of Aberdeen addresses a gap relating to stakeholder engagement in marine spatial planning and decision making. The research developed a novel stakeholder-driven methodology to facilitate understanding of outcomes of policy changes surrounding complex marine ecosystems. The method has increased understanding of how natural capital principles can be applied to ecosystems planning throughout the UK, allowing the broader values and benefits from marine ecosystems to inform decision-making. This approach is being incorporated by fishing industry representatives, by the Joint Nature Conservation Committee which informs UK government policy, and in the 'Marine Pioneer' (UK Government) programme, testing a natural capital approach to decision making and helping implement the UK 25-year Environment Plan.

2. Underpinning research (indicative maximum 500 words)

The advent of natural capital principles and approaches, which consider the value of the natural environment for people and the economy, has been a recurrent theme in UK marine policy since the 2011 National Ecosystem Assessment and 2014 follow on report (http://uknea.unep-wcmc.org/). An examination of the law in Scotland revealed that within the Marine Acts there are multiple mentions of the 'ecosystem approach', which integrates management of land, water and living resources to promote conservation and sustainable use in an equitable way. Yet nowhere is the approach translated into a decision-making process (Slater & MacDonald 2018, [2]). There was therefore an identifiable need to articulate such a process while striking a balance between varied and vested interests, whether that be proposals for offshore wind farms, marine protected areas, industrial fishing or recreational interests. In response, we developed the Ecosystem Service [ES] matrix [3, 6], a participatory systems analysis developed through the 'Cooperative Participatory Evaluation of Renewable Technologies on Ecosystem Services (CORPORATES)' method. This is considered to be the first decision support framework of its kind in the sector [1,2,4, S1] and supports the expansion of participatory methods [7], such as such as mapping activities and benefits associated with different sectors, facilitating joint-sector debate, knowledge exchange, risk mitigation and dialogue on a sector-wide scale in line with UK Policy (http://corporates.moonfruit.com/).

Building the UK's first Ecosystem Services [ES] matrix

Potts has led research on how ecosystems provide a variety of social-cultural benefits (ecosystem services) [6]. The approach developed the ES matrix in 2014, an analysis of all UK, Scottish, English, NI and Welsh protected habitats and species and an assessment of how they contribute to ecosystem services (e.g. CO_2 sequestration, food provision, cultural benefits etc). [6]. The ES matrix was based on an expert-based analysis and peer review quantifying the relationships between protected features and services. We analysed the

contributions of 60 habitat features from EU and UK designations, followed by 70 protected species. The matrix was expanded to include health benefits in 2015 [5] and seabirds in 2017. The output was a peer reviewed UK set of features - ES relationships that has informed UK Policy [see supporting testimonial S10] and applied internationally (see below).

Identifying a test bed for the first UK ES policy framework: CORPORATES

Since 2013, Professor Scott, Dr Potts and Ms Slater have sought to address a policy gap in how to make decisions around ES in the marine context [1]. The CORPORATES framework provides a methodology to identify and understand ecological processes and services. It combines social and ecological sciences to help policymakers, planners and decision-makers comprehend an ecosystems approach. We developed a suite of methods including spatial mapping of activities and benefits, conceptual model building on ecosystem dynamics and trade-off analysis that were applied to two workshops in 2015 with participation from marine renewable energy, fisheries, tourism, local government and conservation NGOs. On request we subsequently facilitated training workshops at the request of SNH (now NatureScot), JNCC and 22 regional Marine Planners [see supporting testimonial S1].

Expanding the role of participatory mapping to assess ES

Drawing upon outcomes of the CORPORATES project we recognised that there were significant gaps in [1] the application of natural capital principles at local scales and [2] an understanding of how to do so. This coincided with the launch of the UK Government's 25-Year Environment Plan, which calls for a requirement to understand the full value of the marine environment, taking into account all potential beneficiaries.

A 10-step decision process was developed from the CORPORATES framework [7] and applied to case studies in Wick, Aberdeen (Scotland), The Humber and The Wash (England). This included co-design of workshops with local coastal partnerships; using GIS layers and SENTINEL satellite imagery to map natural and human features and connect them to ES benefits; co-design of scenarios to test the variability of services and benefits against a range of forces (e.g. climate and land use); and logic chain analysis for distribution of benefits. This informed the Defra / Marine Management Organisation (MMO), UK Government initiative. (https://www.gov.uk/government/publications/marine-pioneer) [S9].

3. References to the research (indicative maximum of six references)

References (citations vis Scopus)

[1]* **Slater AM**, Irvine, K, Byg, A, Davies, I, Gubbins, M, Kafas, A, Kenter, J, **MacDonald, A**, O'Hara Murray, R, **Potts, T,** Tweddle, J, Wright, K, **Scott, BE.** (2020) Integrating stakeholder knowledge through modular cooperative participatory processes for marine spatial planning outcomes (CORPORATES). *Ecosystem Services*. https://doi.org/10.1016/j.ecoser.2020.101126, 2 citations

[2]* **Slater, A-M** & **MacDonald, A** 2018, Embedding Law in Participatory Processes Enables an Ecosystem Approach to Marine Decision Making: Analysis of a North Sea Example. In *The Ecosystem Approach in Ocean Planning and Governance*. Leiden. https://doi.org/10.1163/9789004389984_010

[3]* Burdon, D, **Potts, T,** Barbone, C, Mander, L. (2017) The matrix revisited: A bird's-eye view of marine ecosystem service provision. *Marine Policy*, 77: 78-89. https://doi.org/10.1016/j.marpol.2016.12.015, 17 citations

[4] **Scott, BE**, Irvine, K, Byg, A, Gubbins, M, Kafas, A, Kenter, J, **MacDonald, A**, O'Hara Murray, R, **Potts, T, Slater, AM**, Tweddle, J, Wright, K, Davies, I. (2016) The Cooperative Participatory Evaluation of Renewable Technologies on Ecosystem Services (CORPORATES). *Scottish Marine and Freshwater Science* Vol 7 No 1. http://www.gov.scot/Publications/2016/02/4961 and Marine Scotland Topic Sheet 16 V1 https://www2.gov.scot/Topics/marine/Publications/TopicSheets/tslist/corporates

[5]* Saunders, J, **Potts, T**, Jackson, E, Burdon, D, Atkins, JP, Hastings, E, Langmead, OL, Fletcher, S. "Linking Ecosystem Services of Marine Protected Areas to Benefits in Human Wellbeing?' In: Turner, R.K. and Schaafsma (eds) Coastal Zones Ecosystem Services:

Studies in Ecological Economics Volume 9. Springer, 2015. p. 167-191. https://doi.org/10.1007/978-3-319-17214-9_9, 1, 300 downloads

[6]* **Potts, T**, et al. (2014) Do marine protected areas deliver ecosystem service functions that support human welfare? *Marine Policy* 14: 139-148 https://doi.org/10.1016/j.marpol.2013.08.011, 149 citations

[7]* D. Burdon, **Potts, T**., McKinley, E., Lew, S., Shilland, R., Gormley, K., Thomson, S., Forster, R. (2019) Expanding the role of participatory mapping to assess ecosystem service provision in local coastal environments. Ecosystem Services, 39. https://doi.org/10.1016/j.ecoser.2019.101009, 19 citations

* = peer reviewed

Grants

Scott, Slater and Potts Cooperative Participatory Evaluation of Renewable Technologies on Ecosystem Services (CORPORATES), NERC (1/07/14-31/03/16) GBP85,552.

Potts Evaluating service flows from marine protected areas: case studies from Scotland, UK and Xiamen, China. Royal Society of Edinburgh (1/04/15-31/01/18) GBP11,680.

Scott. Supergen ORE Hub. EPSRC(1/07/18-30/06/22) GBP9,000,000,000 (GBP394,203.91 to Aberdeen, 50% by 2020)

Potts (Knowledge Exchange and Commercialisation Award, internal pump priming support from University of Aberdeen), (2019) GBP9,000.

4. Details of the impact (indicative maximum 750 words)

Research led by the University of Aberdeen has underpinned the development of three frameworks: the ES matrix, the CORPORATES framework and Participatory Mapping. Collectively they underpin new approaches to policy processes around ecosystem services and the multiple uses of the marine environment [2]. For example, the Head of Planning and Strategy at Marine Scotland stated, "*….how this (CORPORATES) has been set out has influenced a lot of what we (Marine Scotland) do in these types of approaches. Because it is taking it from that high level and trying to ground-truth it".* A representative from N Power, found the CORPORATES approach valuable: *"I found the environment conductive to discussions that I wasn't necessarily expecting. After 20 years in this business, I had never thought about it this way before".*

The methods have provided evidence, tested new stakeholder engagement and planning techniques and knowledge exchange under the Scottish National Marine Plan (2015) and the UK 25-Year Environmental Strategy [see supporting impact statements]. The research has made an impact in influencing the UK Joint Nature Conservation Committee natural capital assessments and regional marine planning.

Shaping dialogue and informing decision-making between regulators, statutory bodies and marine industries.

The CORPORATES framework has been influential in understanding the ecological, social and economic trade-offs between renewable energy, Marine Protected Areas and commercial fishing [testimonial S1]. CORPORATES has informed fisheries research [1] and marine planning guidance [S2]. The ES matrix and participatory mapping have influenced fishing industry discussions on natural capital and how fishing can support or undermine services [S3]. This was the first foray by SEAFISH (a public body set up to support the seafood industry) into ES and our work in [S3] informed SEAFISH strategy.

CORPORATES has been adopted and published as Scottish Government scientific guidance informing marine planning at a site scale [2]. The approach has also led to an acceptance by regulators, statutory bodies and marine industries that there needs to be a profound shift in the policies regarding the current approach to strategic environmental assessment and environmental impact assessment. The ES matrix has been used to inform regulatory assessment, for instance as a contributing evidence base to support the appraisal of Scottish

Marine Protected Areas [S4]. The research has also informed global Marine Protected Area assessments (149 citations of Potts *et al* 2014) [3] and the UK Department of Business, Energy and Industrial Strategy (DBEIS) is funding our work (GBP40,000 investment for a PhD studentship) on a Bayesian modelling approach for sustainable marine ecosystems and offshore energy.

Informing marine planning and natural capital accounting and assessment.
The ES Matrix and related outputs has informed policy and scientific debates about how natural capital accounting can support marine planning and assessment by integrated understanding of the connections between marine social-ecological systems. For example, our research outputs [3,6, above] formed a part of the evidence base for a Joint Nature Conservation Committee assessment on the ecosystem services for marine habitats [S5]. Research outputs contributed to the UK national assessment of 'good environmental status' under the EU Marine Strategy Directive. Our work featured in the section 'evaluation public pressures' with direct reference to our participatory mapping work [7] in the assessment [S6]. In terms of marine planning programs at the regional scale, our work directly informed the Shetland Islands Marine Region State of the Environment Assessment, with our 2014 and 2017 papers cited upfront as 'key literature' [S8]. The Environment Agency has used our literature and data to inform and guide a 2020 assessment of benthic ecosystem services in the Solent [S9].

Embedding place based participatory natural capital and ecosystem service assessments in UK policy and planning.
The ES Matrix and participatory mapping approach were deployed to support the UK Marine Pioneers as test cases [testimonial S10]. In 2019 we led the Suffolk Pioneer to test how natural capital can be delivered in local pilots. The method explored how natural capital concepts could be applied in the Deben Estuary in workshops with policy, industry and community representatives.

The methods [7] were adapted in the Deben to explore scenarios of change on sea level rise and land use. The outputs included an operational manual for participatory mapping [S11] adding to the evidence base for planning directed by the Marine Management Organisation. The work was developed in partnership with Scottish and UK policy agencies (JNCC, SNH, and Marine Scotland), local authorities (Aberdeen and Aberdeenshire) and community organisations (EGCP, Moray Partnership, and Wick) providing a peer reviewed and tested means of delivering a ecosystems approach to natural capital management of the marine environment.

5. Sources to corroborate the impact (indicative maximum of 10 references)

Corroborating Sources [S]

[S1] Marine Scotland and Marine Scotland Science (MS and MSS) Testimonial letter. Deputy Director of Marine Scotland Science and Head of Planning and Strategy, Marine Planning and Policy

[S2] Batts, L., Shucksmith, R., Shelmerdine, R.L., Macdonald, P., Mouat, B. Understanding and influencing the marine management and development processes - Best practice guidance for fishers. Report for Fisheries Innovation Scotland, project FIS014:. https://bit.ly/3uvKmji

[S3] SEAFISH (2019) Ecosystem services and the UK seafood industry: https://bit.ly/2NE2KpJ [Page 11]

[S4] Planning Scotland's Seas: 2013 - The Scottish Marine Protected Area Project – Developing the Evidence Base tor Impact Assessments and the Sustainability Appraisal Final Report https://bit.ly/3aO1sBi [Page 27]

[S5] JNCC 2020. *Review of the Evidence Supporting the Provision and Resilience of Ecosystem Services of Select Marine Habitats and Species*. 10 January 2020. https://bit.ly/3qVr3Oq

[S6] UK Marine Online Assessment Tool. 2019. UK Government & Cefas. https://moat.cefas.co.uk/> Contribution located: https://moat.cefas.co.uk/uses-of-the-marine-environment/evaluating-public-perceptions/ (Case study 6).

[S7] Hooper, T., and Austen, M. 2020. Application of the natural capital approach to Sustainability Appraisal. Method Summary. October 2020. Report prepared as part of the South West Partnership for the Environment and Economic Prosperity (SWEEP) and the Marine Pioneer programme. [Cited on pg.15 as a detailed marine example].< https://bit.ly/2ZT7dHn>

[S8] Shucksmith, RJ (2017) Shetland Islands Marine Region State of the Marine Environment Assessment. NAFC Marine Centre UHI. Report for the Shetland Islands Marine Planning. Partnership. pp 172;https://bit.ly/2ZPSey7;[pg.4]

[S9] Watson, S.C.L., Watson, G, J., Mellan, J., Sykes., T., Lines, C., Preston, J., (2020) Valuing the Solent Marine Sites Habitats and Species: A Natural Capital Study of Benthic Ecosystem Services and how they Contribute to Water Quality Regulation. Environment Agency R&D Technical Report ENV600. https://bit.ly/3qWlAXu [Page. 22 and 23. Direct data used in assessment].

[S10] Marine Management Organisation (MMO) Testimonial letter. Head of Marine Evidence.

[S11] Burdon D, Potts T (2020) Participatory mapping of natural capital and benefits: method guidance document. Daryl Burdon Ltd, Willerby, UK, report to Suffolk Marine Pioneer, 34pp, (Report No. DB LTD 007/2019c): https://bit.ly/3stfaQ7