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Global Ecological, Social and Economic Impacts of Marine Plastic

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Viewpoint

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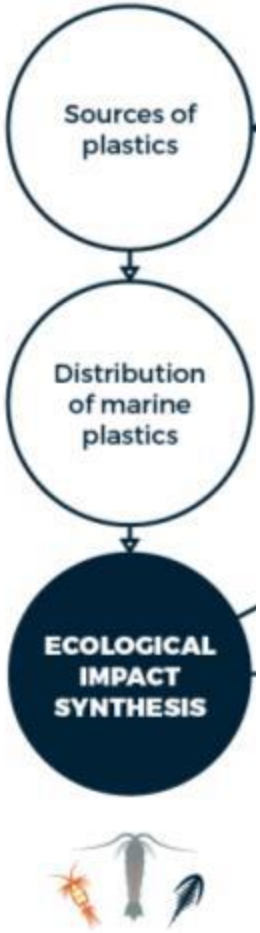
A three-step pluralistic approach



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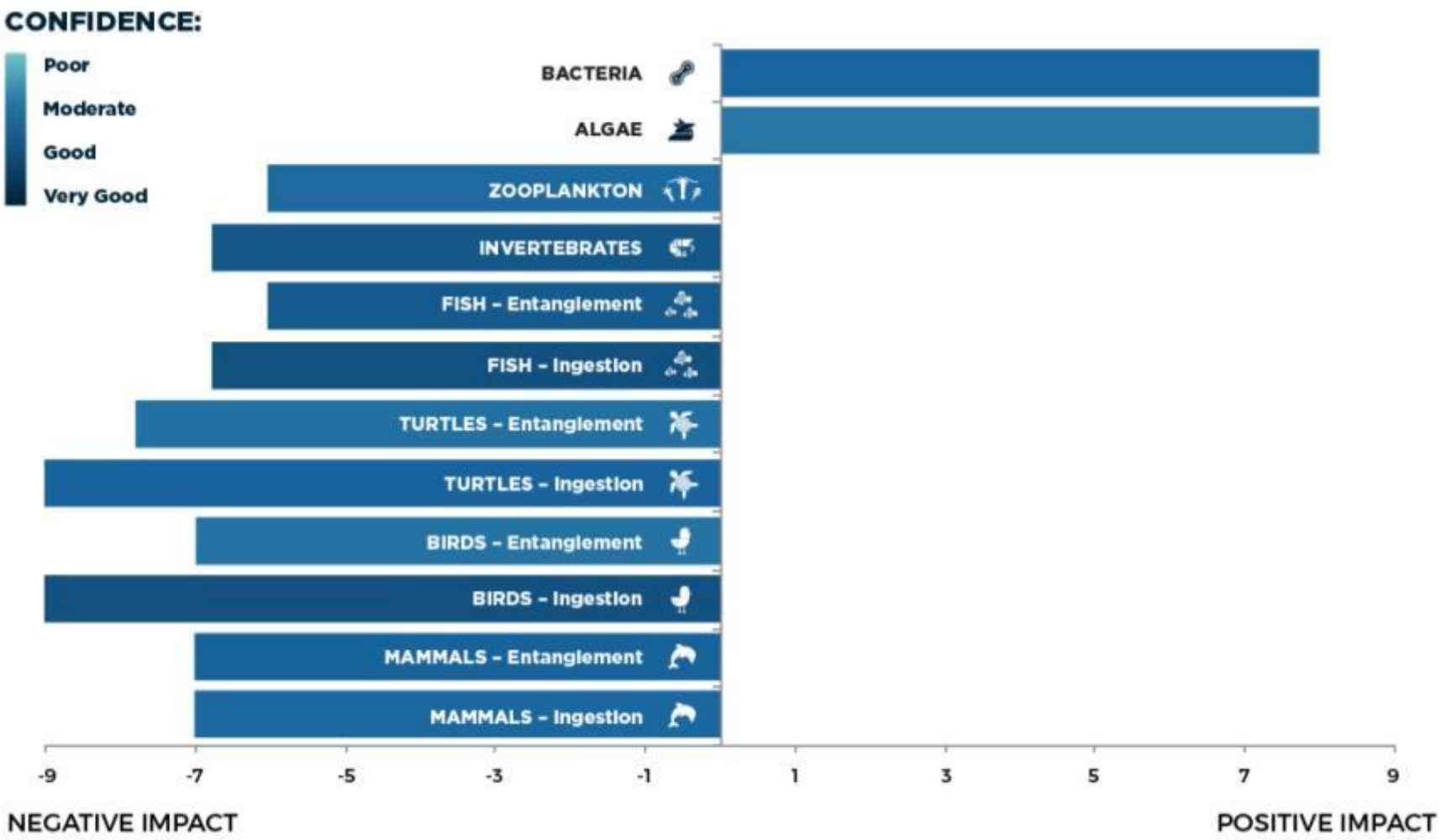
Summary of literature review

	Outcomes															
Subject types	**Abundance of biota**	**Abundance of plastic**	**Colonisation**	**Financial cost**	**Degradation**	**Entanglement**	**Growth**	**Health**	**Human health and wellbeing**	**Ingestion**	**Rafting**	**Metabolism**	**Mortality**	**Reproduction**	**Other**	**TOTAL**
Algae	3	0	17	0	0	0	0	0	0	0	0	0	0	0	3	**23**
Plankton	0	0	0	0	0	0	0	0	0	55	0	0	1	0	0	**56**
Bacteria	0	0	16	0	8	0	0	0	0	0	0	0	0	0	0	**24**
Birds	0	0	0	0	0	13	0	0	0	290	0	0	0	0	14	**317**
Fish	0	0	0	5	0	14	0	0	0	227	1	0	0	0	6	**253**
Mammals	0	0	0	0	0	31	0	0	0	79	0	0	0	0	1	**111**
Turtles	0	0	0	0	0	3	0	0	0	48	0	0	0	0	4	**55**
Invertebrates	8	0	3	3	0	4	2	4	0	29	49	1	4	3	13	**123**
Social	0	5	0	16	0	0	0	0	15	0	0	0	0	0	0	**36**
Degradation	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	**7**
Plastic abundance	0	179	0	0	0	0	0	0	0	0	0	0	0	0	0	**179**
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	**7**
TOTAL	**11**	**184**	**36**	**24**	**15**	**65**	**2**	**4**	**15**	**728**	**50**	**1**	**5**	**3**	**48**	**1191**

Step 1. Ecological Impact of Plastics

Impact is defined as an effect on lifespan and/or reproductive potential (Frequency, spatial extent, reversibility)



The Ecosystem Service (ES) Approach

Conceptual diagram illustrating the ecosystem services provided by oceans and the ways in which humans depend on oceans.

Symbols library courtesy of the Integration and Application Network (ian.umces.edu/symbols), University of Maryland Center for Environmental Science.

Conceptual diagram illustrating the ecosystem services provided by oceans and the ways in which humans depend on oceans.
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Samonte G, Karrer L, Orbach M. 2010. *People and Oceans*. Science and Knowledge Division, Conservation International, Arlington, Virginia, USA.

"the aspects of ecosystems utilised (actively or passively) to produce human well-being" (Fisher et al. 2009)

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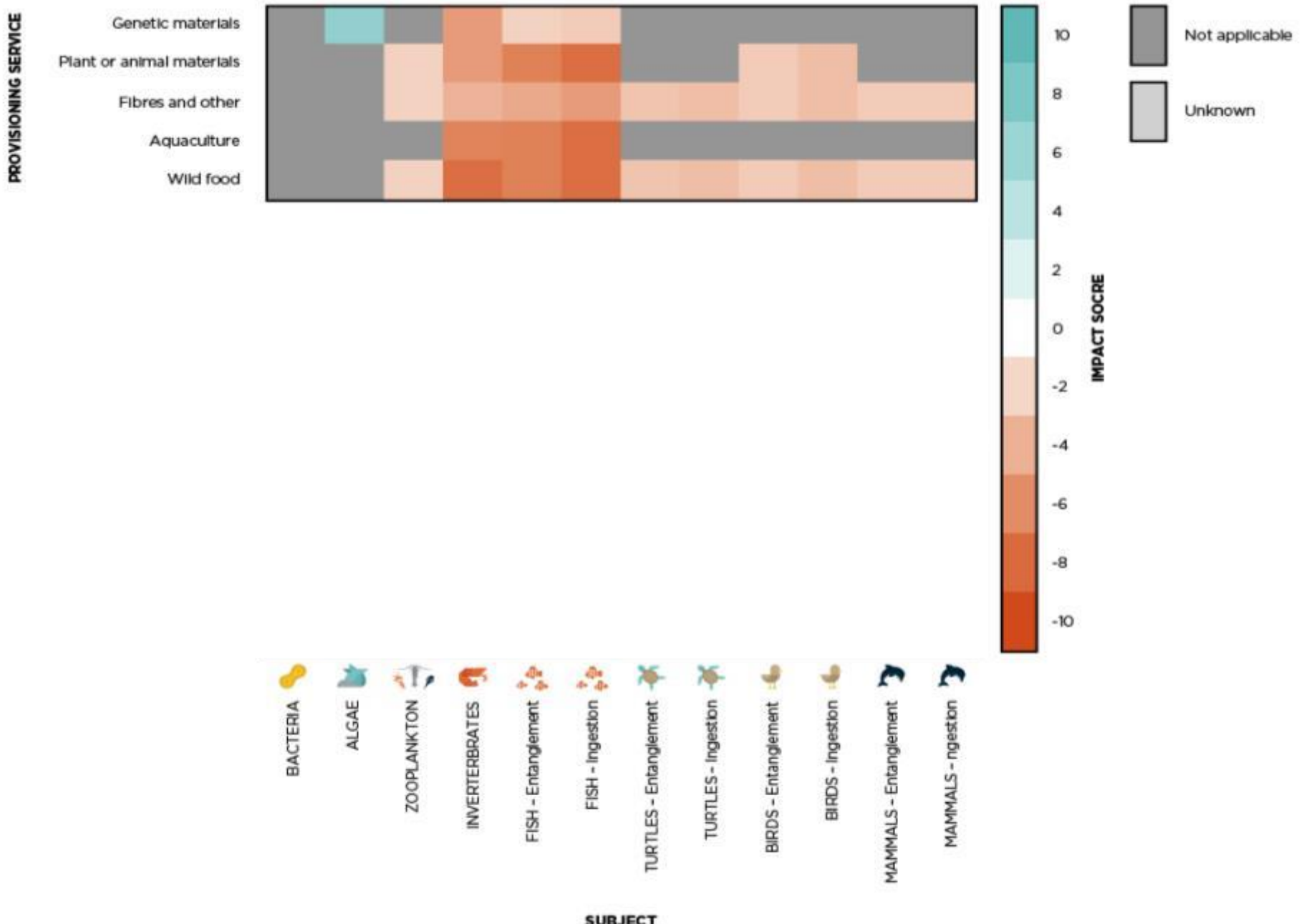
Step 2. Ecosystem Service Impacts



High value, high risk ecosystem service impacts

Reduced efficiency and productivity of commercial fishing and aquaculture

Potential contamination of human food

Loss of charismatic species

Impaired recreational opportunities

A Social Cost for Marine Plastic

Social Cost of Carbon

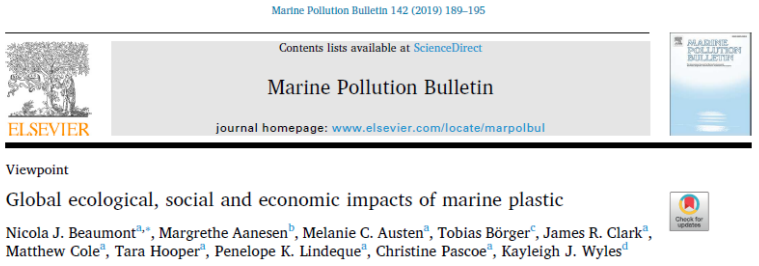
- Social Cost of Carbon is a shadow price of carbon emissions

- Corresponds to the net present value of the cumulative, worldwide impact of one additional t of C emitted to the atmosphere today over its residence time in the atmosphere (Van den Bergh and Botzen 2015).

- If the non-reviewed literature is excluded a mean of US$43 (£28) /tC and an SD of US$83 (£54) /tC is found (Tol 2005)

A social cost of marine plastic?

- On a global scale marine ecosystem services provided benefits to society approximating $49.7 trillion per year (2011)
- 1-5% decline in marine ecosystem service delivery = an annual loss of $500-$2,500 billion in marine ecosystem services
- Marine plastic pollution has an annual cost per tonne of $3,000 - $33,000 - potential for a plastic tax? (e.g. social cost of carbon)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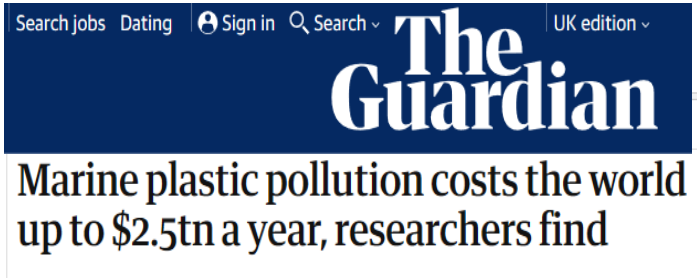

Social Cost of Marine Plastic Limitations

- Underestimate as excludes broader social and economic costs
- SCMP will vary depending on the place of emission, where it moves to and accumulates, its size and type
- SCMP will change in future
- Plastic goes through different 'life stages'

3 Core Recommendations

- A systematic global research agenda for the recording and reporting of marine plastic research. Knowledge gaps – plankton, bacteria, social, economics, health

- The calculation of a holistic social cost of marine plastic (SCMP)

- SCMP to shape future national - global negotiations to change the way plastics are designed, produced, used, reused and reprocessed

THE WIN - Reducing marine plastic pollution is an investment in the future provision of marine ecosystem services, and the human benefits they provide.

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