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The Knowledge Needed for a Sustainable Blue Economy
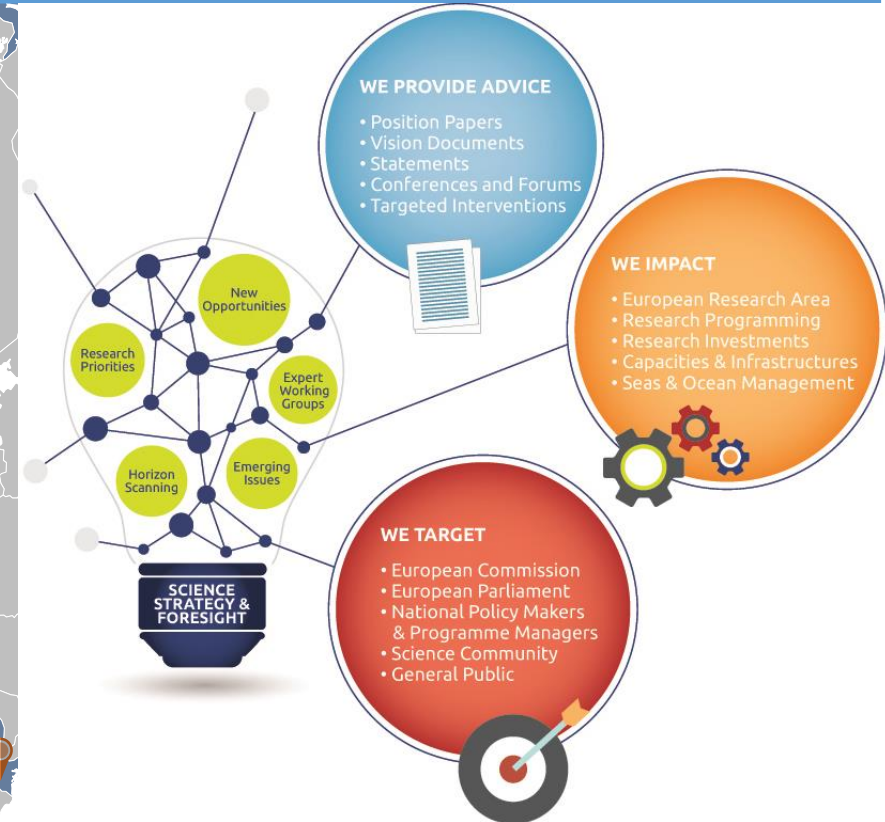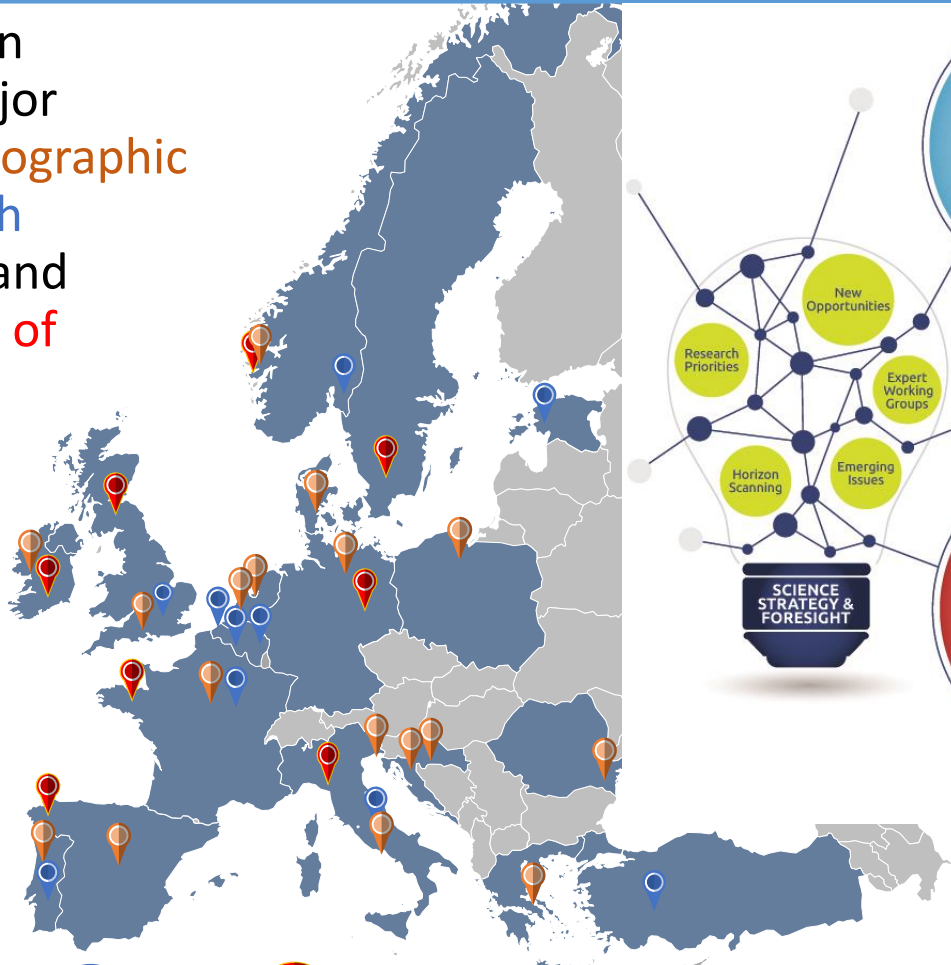
Sheila JJ Heymans
Executive Director

27 October 2020

@sheilaheymans
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European Marine Board

A unique European partnership of major marine and oceanographic institutes, research funding agencies and national networks of universities

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- Vision Documents
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WE IMPACT
- European Research Area
- Research Programming
- Research Investments
- Capacities & Infrastructures
- Seas & Ocean Management

New Opportunities

Research Priorities

Expert Working Groups

Horizon Scanning

Emerging Issues

SCIENCE STRATEGY & FORESIGHT

WE TARGET
- European Commission
- European Parliament
- National Policy Makers & Programme Managers
- Science Community
- General Public

RESEARCH PERFORMING INSTITUTES

RESEARCH FUNDING ORGANIZATIONS

NETWORKS AND UNIVERSITY CONSORTIA

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Navigating the Future V

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Navigating the **Future V**

Position Paper 24

Marine Science for a Sustainable Future

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Authors: Sukru Besiktepe, Ferdinando Boero, Valerie Cummins, Carlos Garcia Soto, Jeremy Gault, Geir Huse, Denis Lacroix, Francesca Malfatti, Jan Mees, Luis Menezes Pinheiro, David Paterson, Catherina Philippart, Ralph Schneider, Anne-Marie Treguier, Jan Marcin Węsławski, Peter Haugan; Gerald Schernewski, Gilles Boeuf, Heidrun Kopp, Kevin Horsburgh, Marta Coll, Martin Le Tissier, Martin Visbeck, Michiel Vandegehuchte, Nele Matz-Luck, Olivier Thebaud, Patrizio Mariani, Sebastian Villassante.
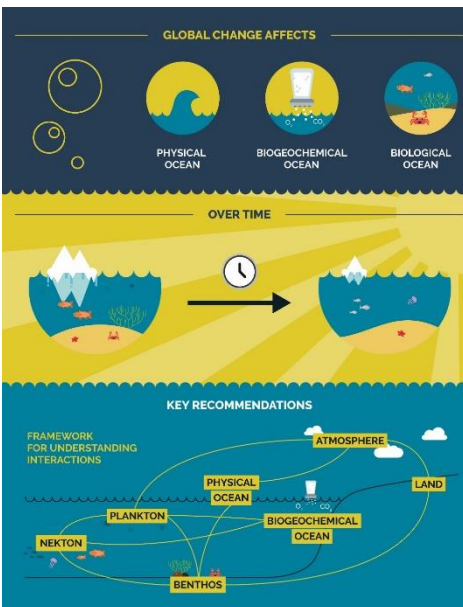
Navigating the Future V

Key scientific questions:

1. **4-Dimensional Ocean** (3D plus time);

2. **Impacts of multiple** and cumulative **human stressors**;

3. How to predict **extreme events**, natural hazards & climate;

4. Advances in **ocean technologies,** modelling & Artificial Intelligence; and
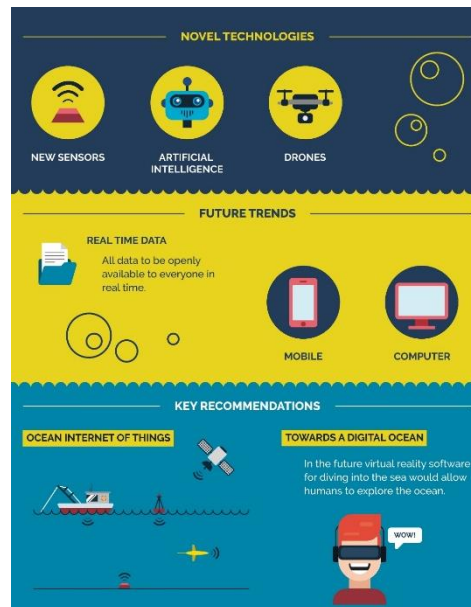
5. Foster **sustainability science**.

4D Ocean	Science of Surprises	Ocean Technologies	Sustainability Science

https://www.marineboard.eu/publications/navigating-future-v

Science needed to understand multiple stressors

- Identify **local, regional, global drivers** and **consequences** of current practices on these;
- Evaluate cumulative effects of all stressors **from an ecosystem perspective;**
- Explore **impact** on the **evolutionary responses** of species and the **mechanisms and speed of adaptation**;
- Study **impact** on the **interaction between species**;
- Combine multi-stressor **experiments** with more **observations**, good **models** in a **transdisciplinary approach**;
- Understand **management objectives** to successfully implement management strategies; and
- More **strategic integrated approach** including social and economic sciences.
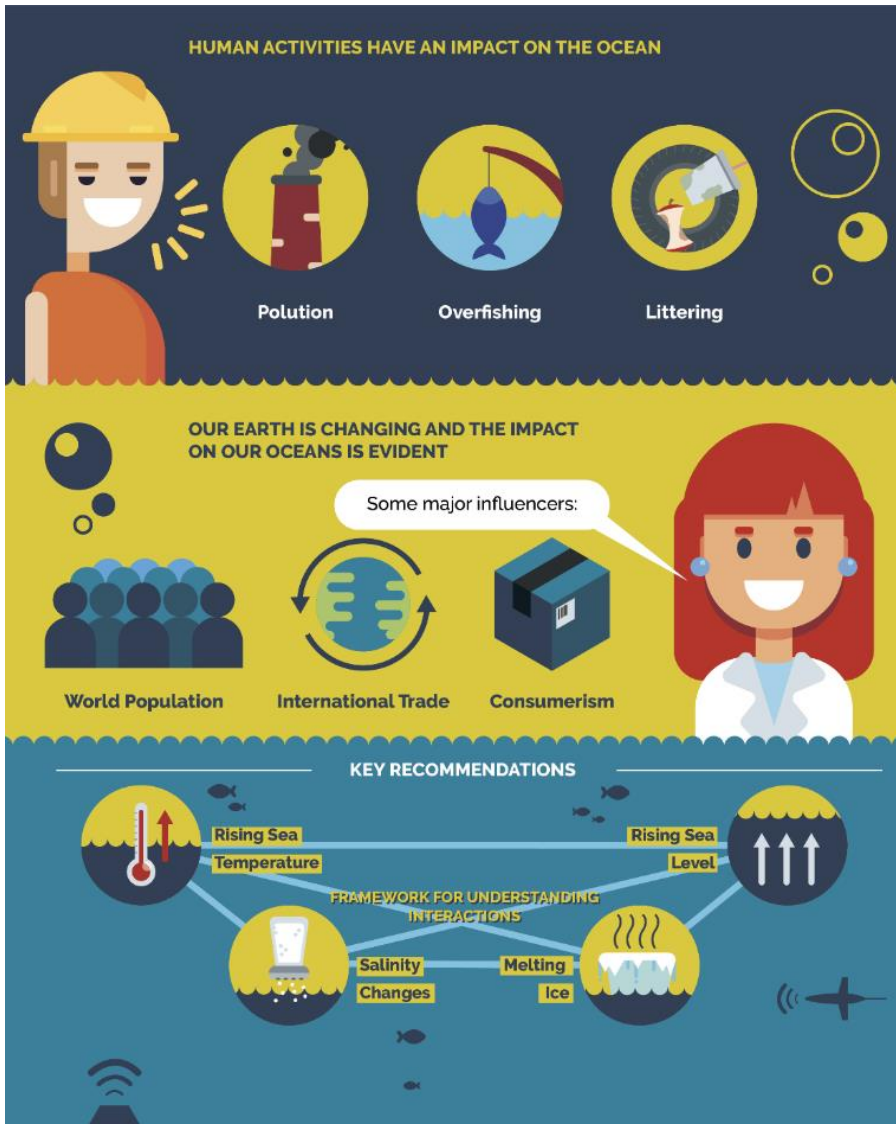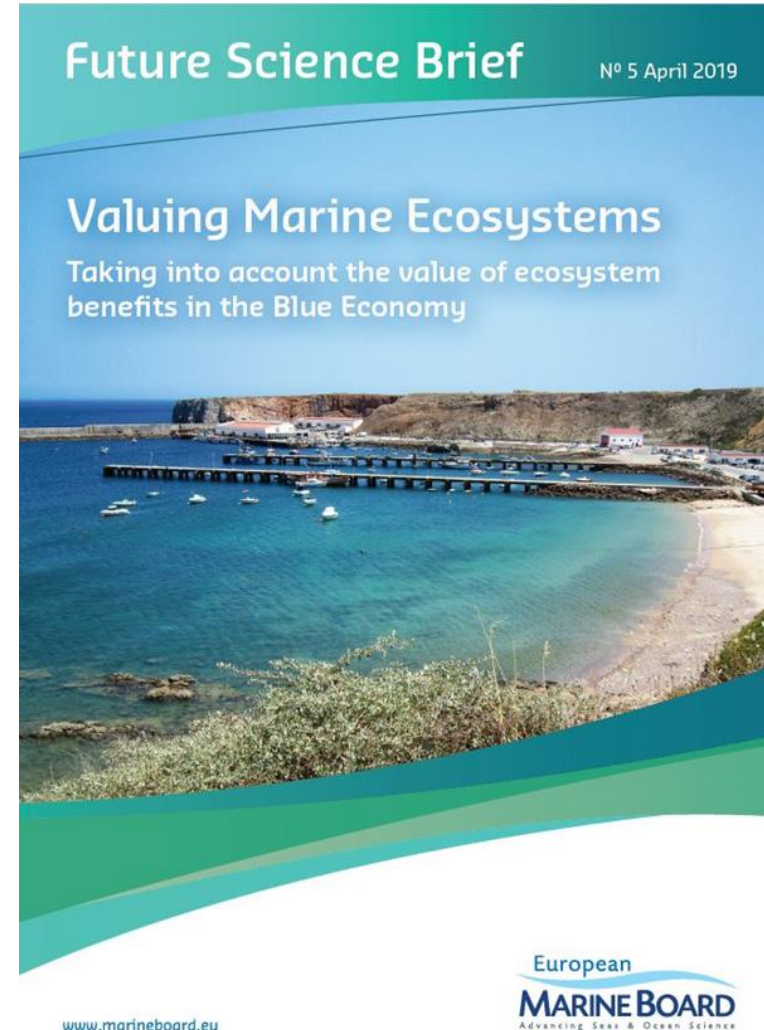
Recommendations from NFV

- Integrate the **4D structure & function** of marine ecosystems **into management practices**;
- Establish an **early-response system** to gain a better understanding of the **short- and long-term impacts of events**;
- Develop a **business model** for the long-term sustainability of ocean observations **co-designed with stakeholders**;
- Create an **ensemble of validated** quantitative physical, biogeochemical, biological, bio-economic and socioecological **models** to **quantify uncertainties** and give **early-warning** indicators for multiple stressors or approaching tipping points;
- Develop the **OIOT** : new technologies; real time observation transfer to satellites/other communication networks and a a **virtual reality ocean platform** where all information is uploaded and visible to the public in real time;
- Promote **dialogue across disciplines**. Train **holistic sustainability scientists**;
- Enhance **marine citizen science** to understand the ocean as a common good whose health is crucial for humanity; and
- Set up a **sustainability science forum**, including industry and civil society partners.

Valuing Marine Ecosystems

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" *Ecosystem valuation* can help *to assess the sustainability* of Blue Growth. *Focusing on sustainability* means that we take into *account the environmental limits* of marine ecosystems, their *spatial distribution* (who benefits and where the ecosystem services are provided) and their *potential to provide sustained benefits* in the Future...

... By evaluating the *impacts of human activity on ecosystem services* and their *social and economic consequences* we can *highlight the trade-offs* between actions to reverse the *declining trends in marine biodiversity* and ecosystem health, and possible *competing economic interests*."

Austen et al. 2019. "Valuing Marine Ecosystems - Taking into Account the Value of Ecosystem Benefits in the Blue Economy." *EMB Future Science Brief No 5*, 32 pp. https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/EMB_FSB5_Valmare_Web_2.pdf

Recommendations:
Valuing Marine Ecosystems

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1. Include ecosystem valuation in **marine management decision models**;
2. **Harmonize** ecosystem services **frameworks**;
3. Develop **ecosystem services indicators** to be included in monitoring programmes;
4. Create **open databases** of marine ecosystem **valuation study results**;
5. Develop **Natural Capital Accounting** approaches;
6. Set the **right boundaries and scales**; and
7. Enhance **trans-disciplinarity:** fundamental, social, economic, public health.

https://www.marineboard.eu/sites/marineboard.eu/files/public/publication/EMB_FSB5_Valmare_Web_2.pdf

Modelling Marine ecosystems

Ecosystem models integrate knowledge/data/information to improve understanding of ecosystem functioning, predict the response to future scenarios, and help implement ecosystem-based management.
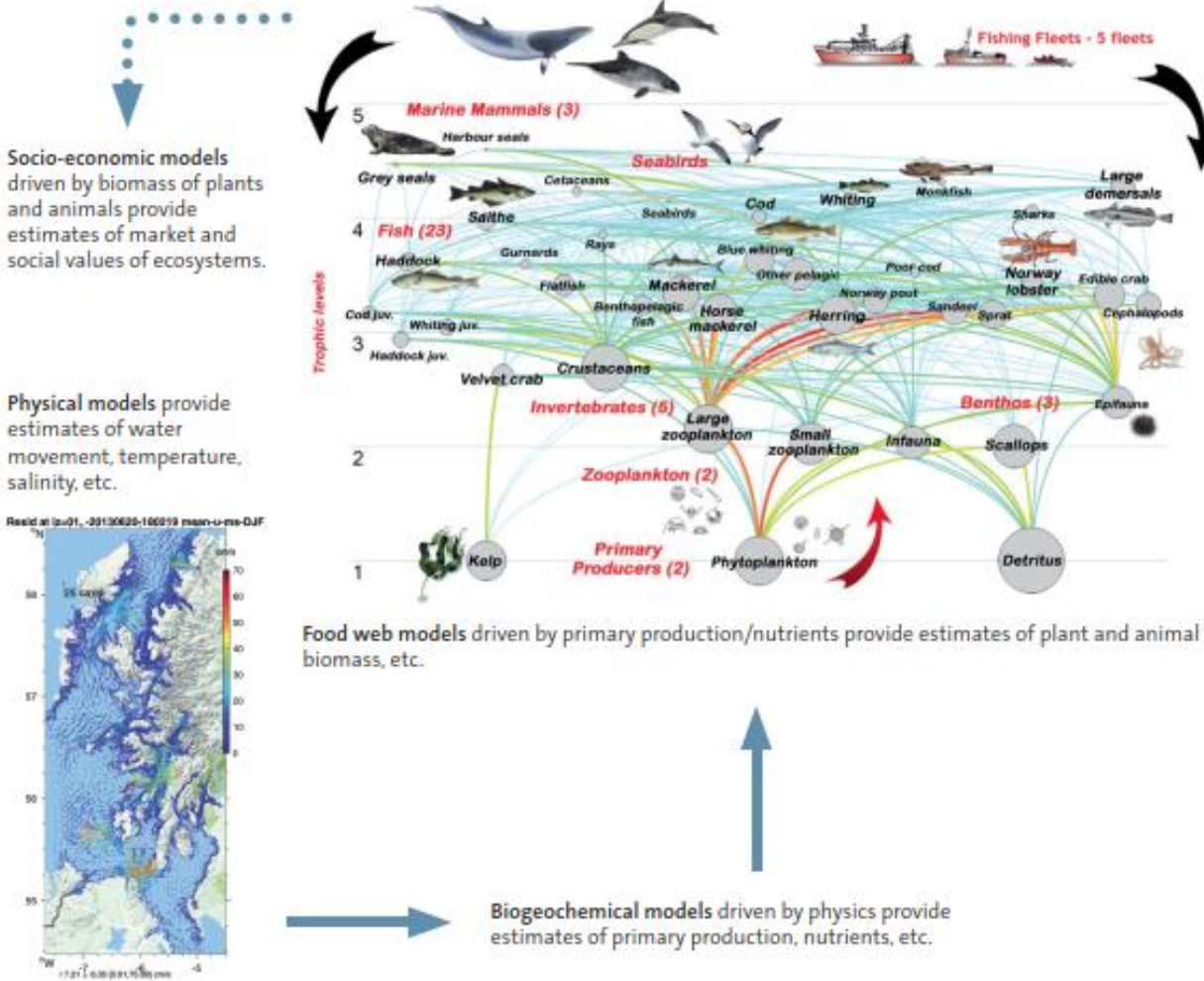
Heymans, et al. 2018. "Enhancing Europe's Capability in Marine Ecosystem Modelling for Societal Benefit." EMB *Future Science Brief No 4*, 32pp.
https://www.marineboard.eu/publications/enhancing-europes-capability-marine-ecosystem-modelling-societal-benefit

Modelling Recommendations

Research and Development needs:

- Collect and **incorporate new data** and information **into marine ecosystem models**;
- Model marine **biodiversity and ecosystem services**, based on critical understanding of marine ecosystems;
- Model **changes in behaviour**, based on **understanding adaptive responses** in marine organisms;
- Evaluate and **reduce uncertainty** in marine ecosystem forecasting; and
- Use new approaches in **machine learning** to enhance ecosystem models.

To **strengthen ecosystem modelling capability:**

- Increase predictability through coordinated experiments and the **ensemble approach**;
- Support the development of next generation models through a **shared knowledge platform for marine models**;
- Make marine ecosystem models **more relevant to management and policy**; and
- Enhance **trans-disciplinary connections** and training opportunities.

Heymans, et al. 2018. "Enhancing Europe's Capability in Marine Ecosystem Modelling for Societal Benefit." EMB *Future Science Brief No 4*, 32pp. https://www.marineboard.eu/publications/enhancing-europes-capability-marine-ecosystem-modelling-societal-benefit
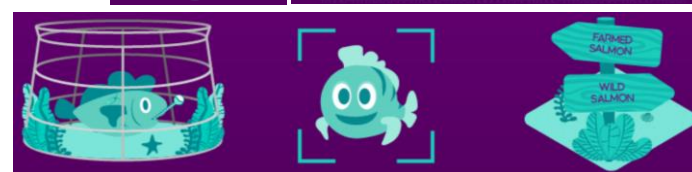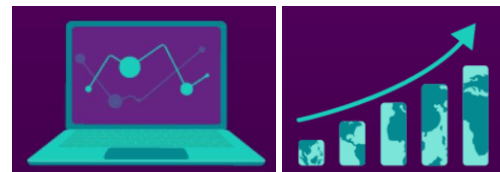
Big Data and AI:

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Future Science Brief Nº 6 April 2020

Big Data in Marine Science

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- Climate and Marine Biogeochemistry
- Marine Conservation
- Marine Biological Observations
- Food Provision

Guidi, et al. 2020. "Big Data in Marine Science." EMB *Future Science Brief No 6*, 50pp.
https://www.marineboard.eu/publications/big-data-marine-science

2020 | BIG DATA IN MARINE SCIENCE 7TH EMB FORUM

- ➢ Green Deal
- ➢ 2030 Biodiversity Strategy
- ➢ Digital Twin Ocean

Watch the FORUM on the EMB youtube channel:
https://www.youtube.com/playlist?list=PLXKTm_QGiR-hkKO6_aGo2t18TjMXY7S7D

Thank you and questions?
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