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The opportunities of the ICOS Oceans Network for marine carbon accounting in shelf seas

Intro

The Flanders Marine Institute

- Marine knowledge creation and excellence through collaboration
- Coastal climate change research
- VLIZ and ICOS Oceans push the state of the art in marine carbon observations -> measurement driven carbon budget for the BPNS



ICOS



**INTEGRATED
CARBON
OBSERVATION
SYSTEM**



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Intro

The Flanders Marine Institute

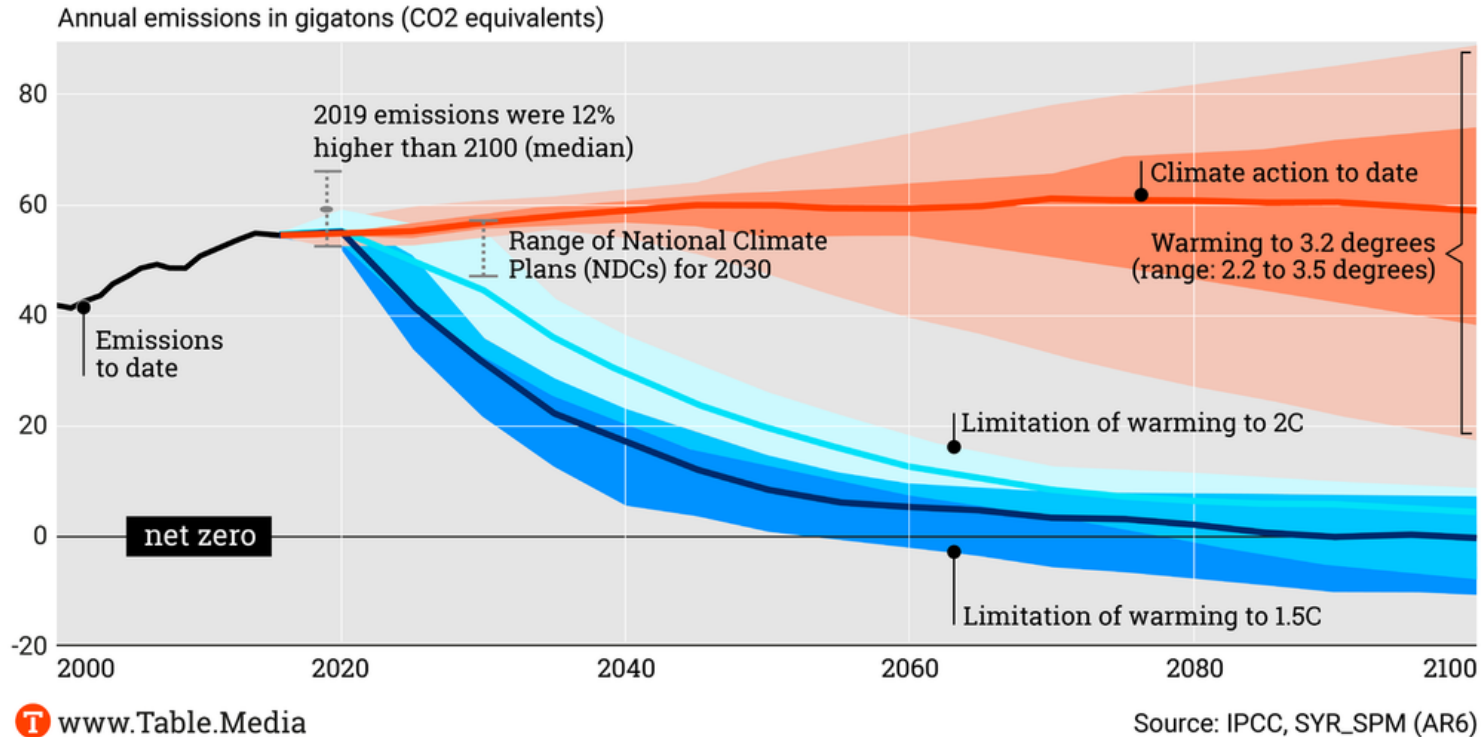
- Marine knowledge creation and excellence through collaboration
- Coastal climate change research
- VLIZ and ICOS Oceans push the state of the art in marine carbon observations
- High quality observation capacity collecting data on carbon concentrations in atmosphere & seawater, next to physical, meteo data and parameters relevant to study the marine carbon cycle



Introduction

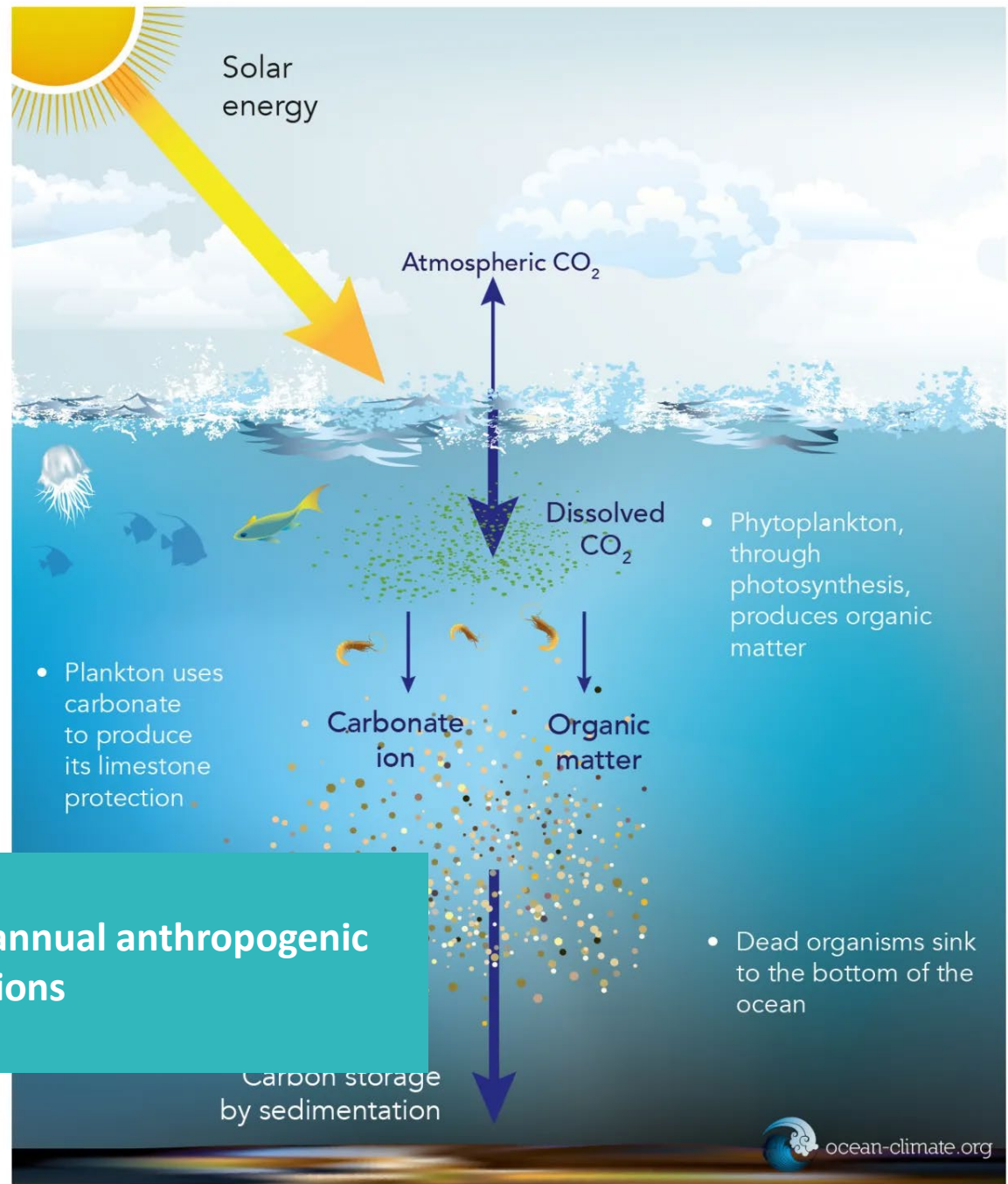
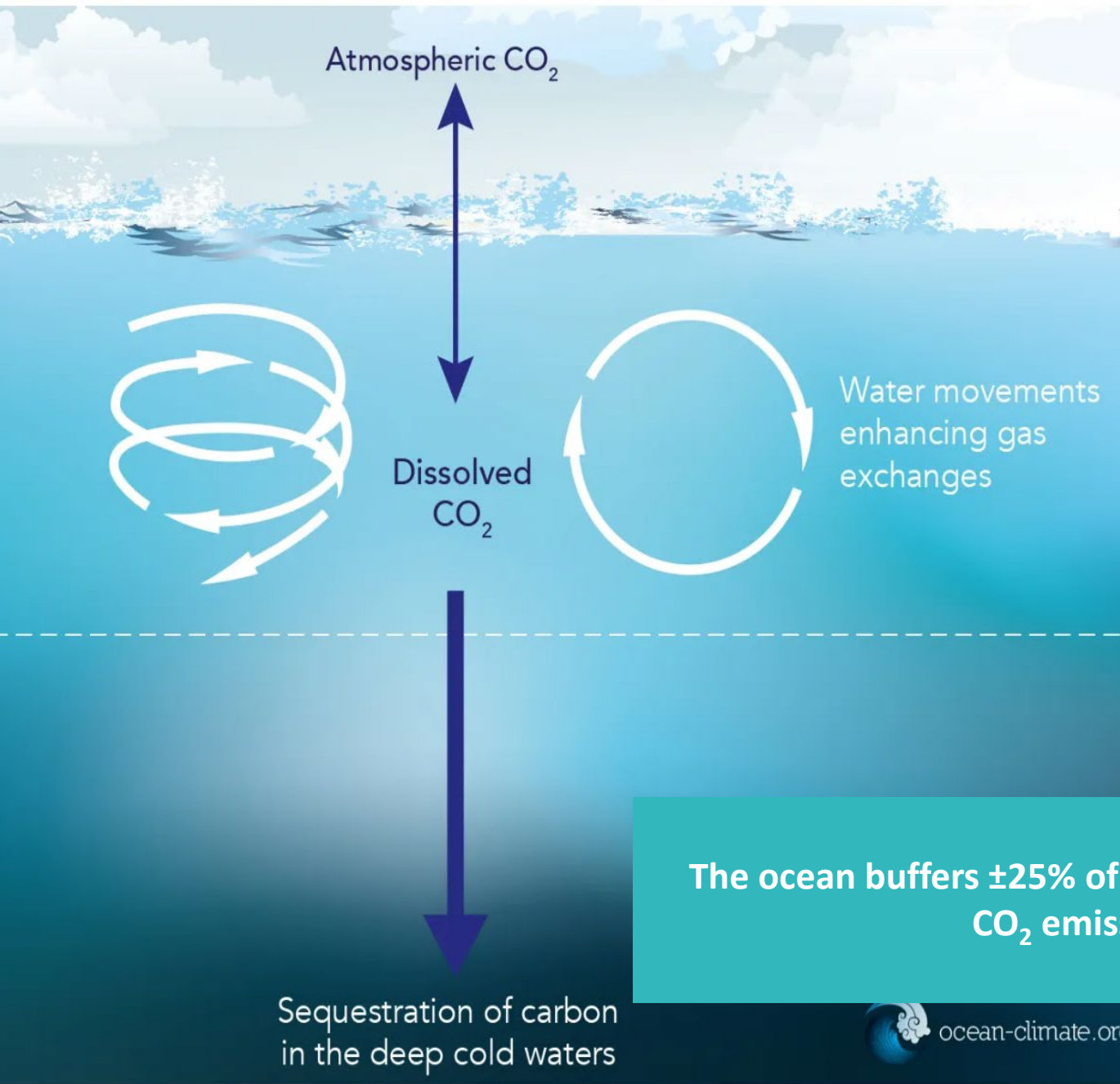
This is how fast emissions would have to fall

Greenhouse gas emissions and expected global warming by 2100



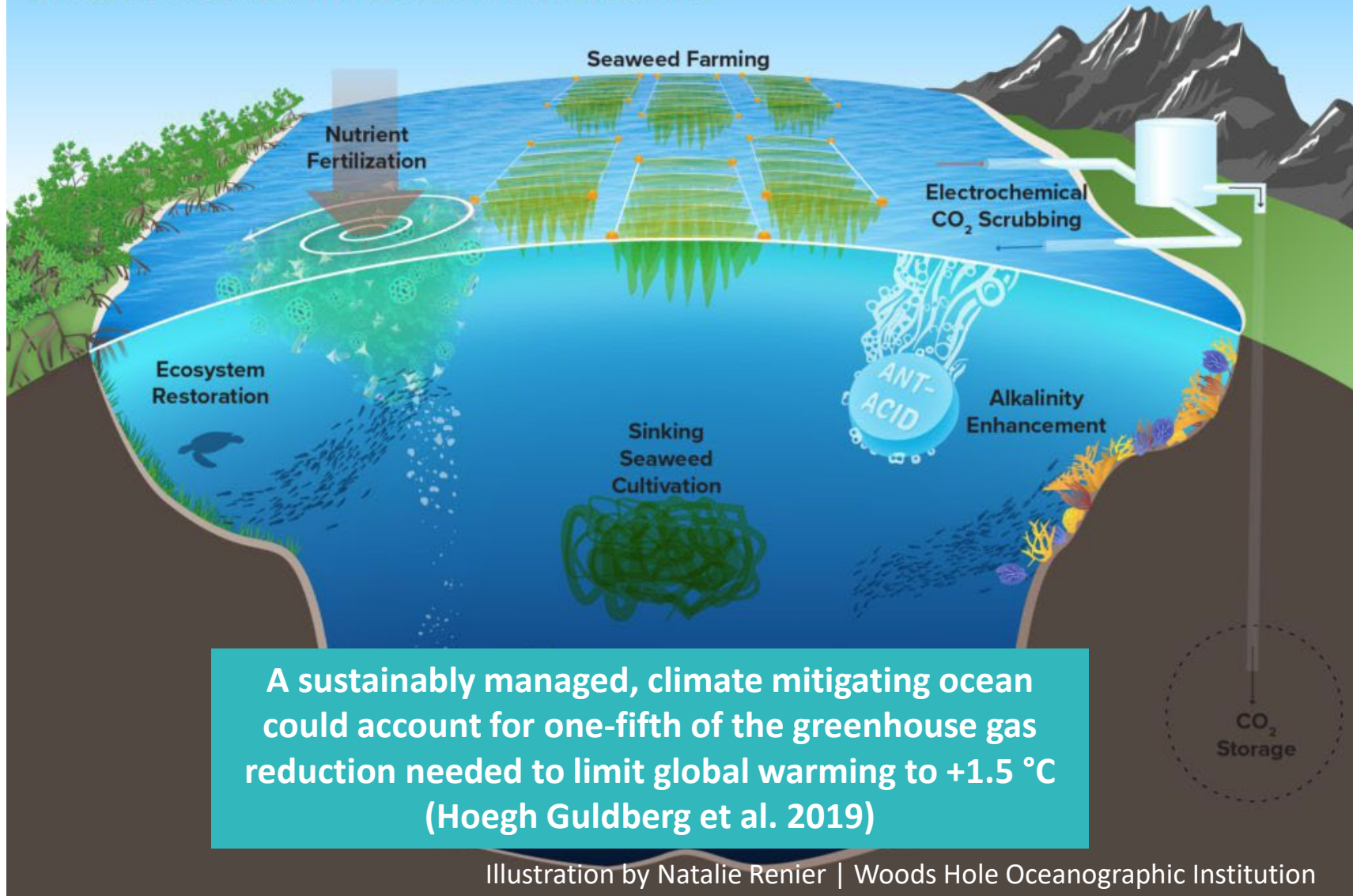
The climate crisis

- Climate action needs to be strengthened and accelerated
- Need for **effective, measurable** and **verifiable** CO₂ reducing pathways



The ocean buffers ±25% of annual anthropogenic CO₂ emissions

Global Solutions for Carbon Dioxide Removal



Natural Capital accounting

Ocean accounting framework

- UN Framework (2021) + Technical guidelines by Global Ocean Partnership (2022)
- Tool for ocean governance by linking marine economics to the environment & vice versa
- Measuring and managing progress towards sustainable ocean development



Policy Informing Brief

The opportunities and challenges of marine carbon accounting - a case study for the North Sea shelf ecosystem and the potential value of the ICOS Oceans Network

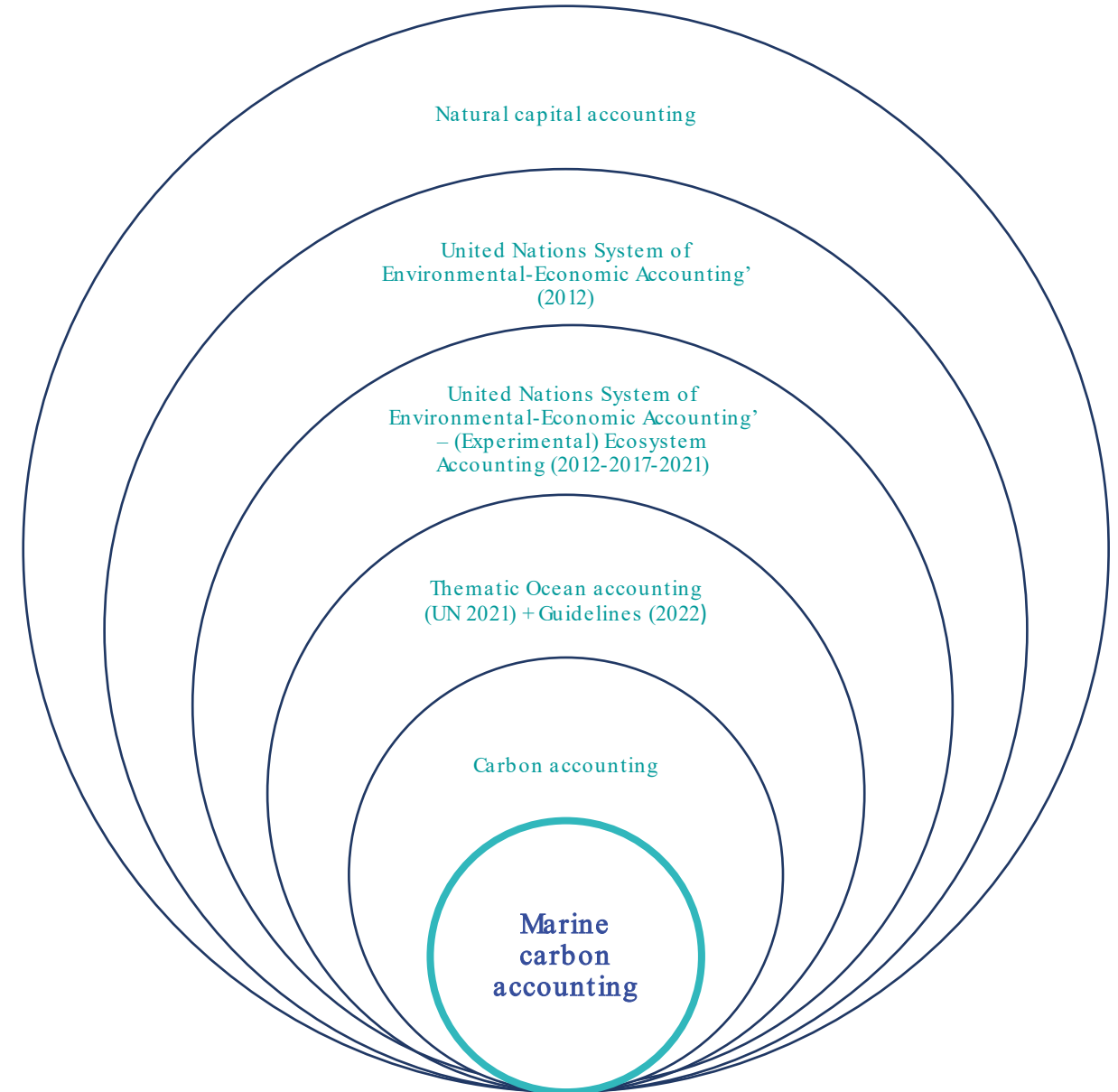
Natural Capital accounting

Ocean accounting framework

- Tool for ocean governance by linking marine economics to the environment & vice versa
- Measuring and managing progress towards sustainable ocean development



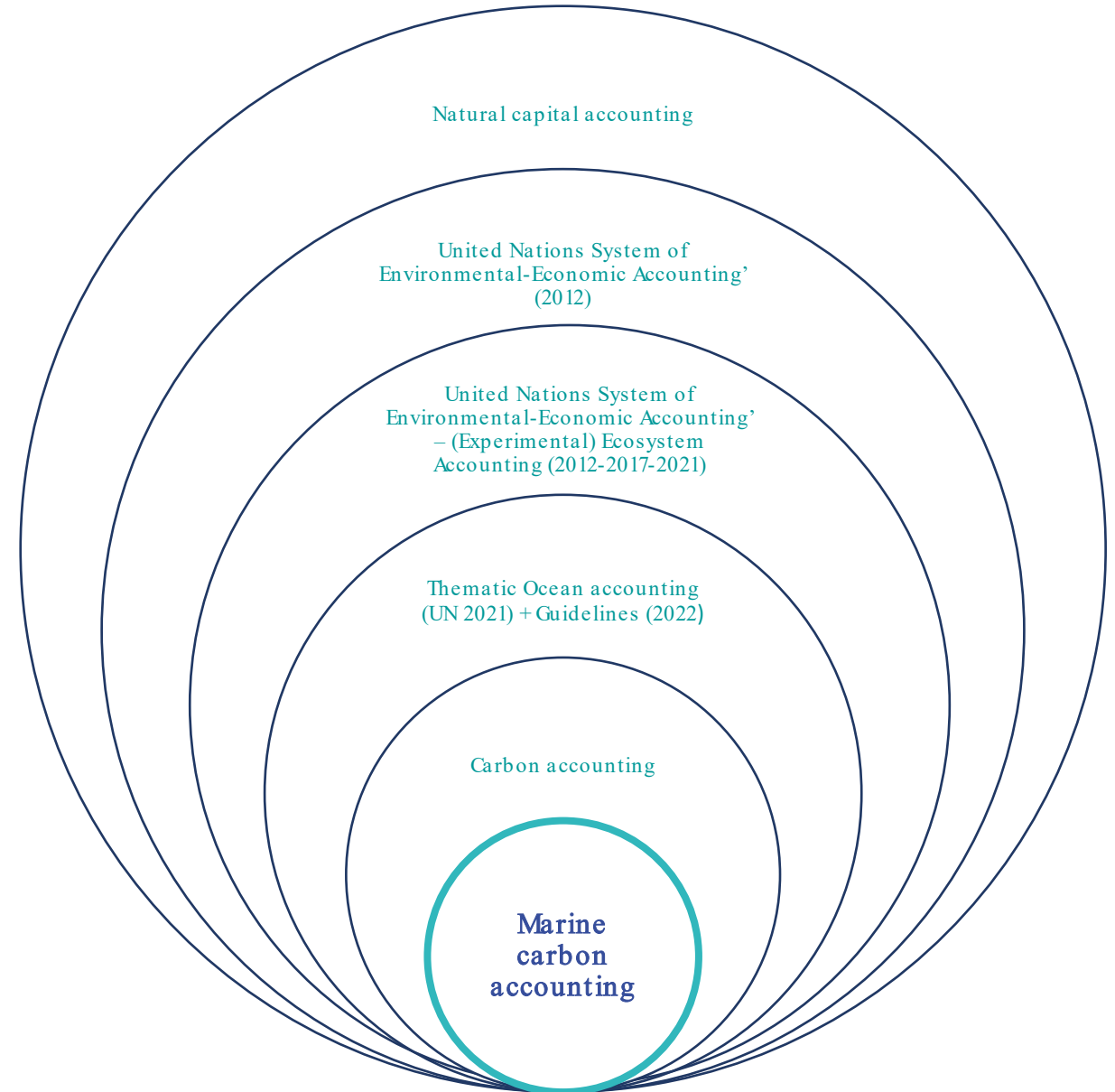
Application stretches farther than climate issue ---> evidence based trade off analysis to guide nature restoration & management, sustainable development of Blue Economy activities, etc.



Ocean accounting framework

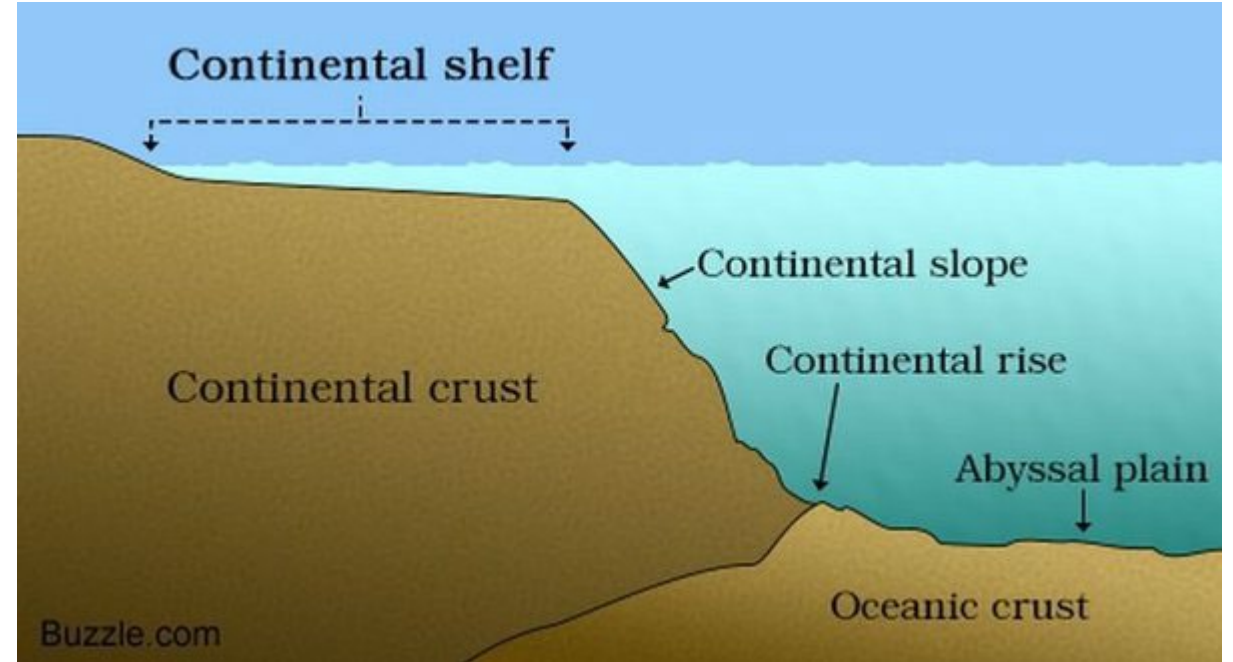
Marine carbon accounting

*“A key element in this exercise is to obtain a thorough understanding of the connections between ecosystem conditions and economic activities, notably through the **direct monitoring of the carbon cycle** and translating this information into **marine carbon accounts**” (Dauwe et al. 2023)*



Marine carbon accounting

Blue carbon ecosystems vs. Shelf ecosystems



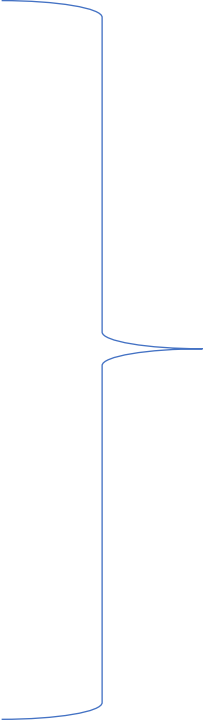
- Great carbon sinks
- Generally well studied
- Carbon sequestration ES traded on Blue Carbon trading markets

- Large stocks of organic sedimentary carbon
- **Long-term carbon sequestration**
- Vulnerable to bottom disturbance

Shelf ecosystems

Major scientific uncertainties:

- Transfer routes of carbon
- Size and stability of carbon stocks and fluxes
- Carbon sequestration rate
- Geographic distribution of major organic carbon stocks



No IPCC carbon budgetting guidelines!

Shelf ecosystems

Reliable marine carbon accounting framework, including all carbon stocks and flows (including anthropogenic), is a requirement to identify shelf ecosystems as accountable carbon sinks within UNFCCC Climate Agreement

- Basic set-up of marine carbon accounting scheme:
 - **spatial** extent of the habitats concerned;
 - the ecosystem condition account (state/quality) measured by **biophysical indicators**;
 - ecosystem service **supply and use accounts**, e.g. carbon sequestration rate (e.g. ton CO₂e/ha/year);
 - monetary value of the provided goods and services, in this case carbon sequestration (e.g. EUR ton CO₂e/ha/year);
 - the ecosystem monetary asset account based on valuation of future ecosystem services (e.g. tracking changes in the carbon stocks).

The potential of the ICOS Oceans Network

- **ICOS data are a key element to progress marine carbon accounting**
 - Mapping of detailed spatially-explicit carbon fluxes
 - Standardized, high-quality and routinely replicated surveys



Reduce uncertainties in climate mitigation measures, identify harmful climate impacts, allow for a more precise management of marine ecosystems and spatial planning, quantify the carbon impact of Blue Economy activities, etc.

Examples of marine carbon accounting valorisation by ICOS data

- ICOS Ocean activities are well placed to **develop methods** that provide a **clearer, spatially explicit picture on stocks, flows and balance of marine organic carbon** and hence assist in **disentangling the fate of the carbon conundrum** in shelf seas and verify emission reductions;
- With the increasing urgency of carbon dioxide removal techniques and net-zero emission pathways, the ability of ICOS to collect **qualitative, standardized carbon observations** will be a cornerstone towards the development of standardized, transparent and reliable marine **carbon accounting guidelines and subsequent government frameworks** that can assist in the development of **new IPCC-guidelines for the inventory of marine carbon in shelf seas**;
- The continuously collected ICOS measurements can prove very informative for **an early detection of changes and trends in the condition of the ecosystem** (for instance the detection of remineralised organic carbon after human disturbance). This is particularly relevant in the North Sea where bottom disturbing practices are common practice. This info **will improve marine and coastal management** by enabling timely and targeted interventions or highlight areas of concern;

Examples of marine carbon accounting valorisation by ICOS data

- The in-situ data streams collected using a scientifically underpinned, high-quality and replicable monitoring strategy can function as a **blueprint to be used within major international carbon budget systems and carbon offsetting schemes**. Moreover, having a specialized and cost-efficient monitoring strategy for marine carbon is highly valuable to Blue Economy projects;
- The ICOS data can increase the likelihood that the carbon capture and storage capacity of shelf seas can be **traded on the international carbon market**, thus **supporting the development of new climate finance opportunities/strategies**, which are expected to boost investments into novel, sustainable business opportunities or nature restoration projects, climate action (e.g., Blue Bonds, a financial instrument that rewards the positive impact companies within the Blue Economy can have on the UN SDGs and which has swiftly proven to be an effective tool to accelerate sustainable Blue Economy activities and catalyze investments towards achieving the UN SDGs);
- ICOS data will help determine **the economic value of carbon sequestration in a more precise way**.

Interested in more?

Dauwe, S.; Pirlet, H.; Gkritzalis, T.; Landschützer, P. (2023). The opportunities and challenges of marine carbon accounting - a case study for the North Sea shelf ecosystem and the potential value of the ICOS Oceans Network. *VLIZ Beleidsinformerende Nota's, 2023_01*. Flanders Marine Institute (VLIZ): Ostend. 34 pp.

Dauwe, S.; Verleye, T.; Pirlet, H.; Martens, C.; Sandra, M.; Moulaert, I.; De Raedemaecker, F.; Devriese, L.; Chisala, C.; Mees, J. (2021). Mariene klimaatmitigatie: een wetenschappelijke synthese van de meest pertinente oplossingsrichtingen voor het Noordzeegebied. *VLIZ Beleidsinformerende Nota's, 2021_003*. Vlaams Instituut voor de Zee (VLIZ): Oostende. 70 pp.



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ICOS

Integrated
Carbon
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Thank you



Questions?

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