

How can cruise shipping promote solutions to climate and biodiversity challenges?

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Sustainability is the word of the day - but what does it mean?

Interpretation of sustainability has evolved over time

- **Earliest interpretation:** renewability at the core: do not use more than growth (1850s), do not pollute more than nature can absorb (1960s)
- **Early twist for nature preservation:** future generations – leave nature and natural resources to future generations at least in the condition you have inherited them (1880s)

- **Limits to growth:** only zero economic growth may save us – if even it (1970s)
- **Sustainable development:** economic growth within the boundaries of nature with a high emphasis on the rights of future generation and present equity (1980s)
- **Planetary health:** humankind is hitting on planetary boundaries, especially on biodiversity and climate (2010s)

- **Planetary health** differs from other interpretations of sustainability, as it recognizes a fundamental change in the humankind's impact on the globe: *the impact has become overwhelming and affects everything*

We need to understand its meaning

Planetary health and planetary boundaries

Biophysical thresholds as planetary boundaries

- Humankind imposes so great impact on the globe that it affects all global ecosystems and material flows
- **Biophysical thresholds:** the levels, where the human impact threatens the carrying capacity of nature and its stability and resilience is at risk

Six thresholds have been crossed over

- **Biodiversity**
- **Biogeochemical flows (N and P)**
- **Novel entities (micro and nano plastics, pfas etc)**
- **Climate change**
- **Land-use change and drinking water**

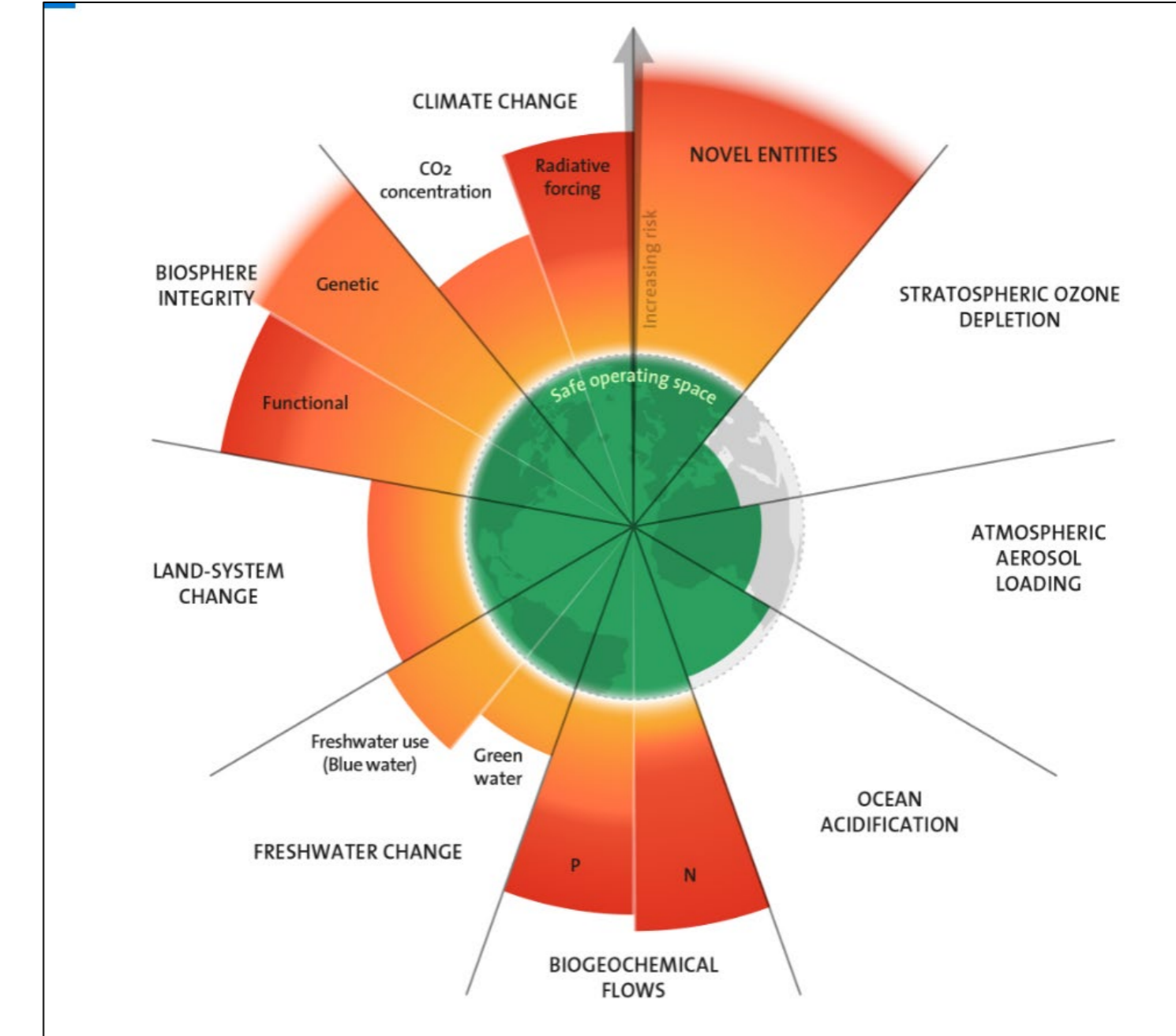
Mutual interdependence: climate change and biodiversity loss

- Climate change boosts biodiversity loss
- Biodiversity loss decreases natural sinks and reinforces climate change
- Climate mitigation is a necessary but not sufficient condition to stopping biodiversity loss

Planetary impacts are global externalities and require international coordination and policy

Oceans: worrying evolvement

- *Acidification increases & threatens aquatic life & oceans' ability to bind CO₂ decreases*
- *Sea temperatures increase and so does freshwater inflow from glaciers threatening the sea currents, like AMOC*



Shipping in global context: main impacts on planetary boundaries

Climate Change & GHG Emissions

- Shipping causes for 3% of global GHG emissions, but its share is predicted to rise to 17% by 2050 if not addressed
- Cruise industry's share is small, 0.0003% of global emissions

Air Pollution & Health

- Sulfur and nitrogen oxides cause acid rain and health problems in coastal areas and cities
- Cruisers: 509 t of sulfur oxide, 19 125 t of nitrogen oxide, and 448 t of PM2.5 in European ports

Biodiversity: marine ecosystem disruption

- *Underwater Noise*: disturbs marine life and disrupts navigation for species like whales
- *Ballast Water*: contains non-native species, which may become invasive and destroy local ecosystems
- *Black and grey water*: cause eutrophication
- *Oil/Chemical Spills*: damage sensitive marine habitats

- *Marine Litter*: Container losses, including plastic pellets, are a source of pollution
- *Black Carbon* in the Arctic: from ship fuels accelerates the melting of Arctic snow and ice, fostering global warming and changes in nature

Shipping – how to be a part of sustainable solution?

All industries should take part in solving the climate and biodiversity crisis

- **Paris Agreement** (2015) for climate: stabilize the increase in global temperature well below 2° C and strive for 1,5° C
- **Kunming-Montreal Protocol** (2022) for biodiversity: stop biodiversity loss and shift to net positivity

How to align shipping to global climate and biodiversity targets?

- **EITHER:** By companies' voluntary actions: align to the global goals via [science-based targets](#)
- **OR:** Societies impose mandatory policies and companies comply
 - IMO-based regulation
 - Country-based regulation: shipping to emissions trading in EU and Britain

Does it matter and which way?

- Yes, it does – as we will see soon – and we need both

Key components to think

Key parts

- Cruisers: materials, energy and services
- Ports: services (wastewater, electricity supply), coastal habitats
- Routes: Particularly Sensitive Sea Areas (and possible others)

Cruisers

- *Energy*: alternative solutions: LNG, renewables, batteries and rotor sails; ammonium and hydrogen
- Building materials: steel and others

- Energy efficiency: warming & cooling, lights
- Waste management: sewage and grey waters to tanks in ports
- Services on board: sustainable food and others

Science-based targets (SBTi) for shipping: climate

Main features

- **Net-Zero by 2040:** Reduce emissions by 96% by 2040, covering scope 3 emissions from subcontracted transport
- **Immediate Action:** Adopt near-term targets in line with 1.5°C pathways to reduce reliance on carbon offsets

- **Fuel Transition:** Move away from fossil fuels, with specific targets to eliminate the use of energy from coal by 2030

Cruise companies

- Shift to energy sources with zero-emissions: **short-term:** batteries & renewables; **longer term:** new fuels (efuels and green ammonium)
- Regular routes: **green zones** – using sea containers with battery systems and switching containers with fully loaded batteries while staying in ports

GHG Protocol: scopes 1-3 for climate mitigation

Scope 1 emissions: GHG emissions that an organization emits from sources it owns or controls directly

- Cruising company: emissions from fuel combustion in cruisers or from corporate offices

Scope 2 emissions: indirect GHG emissions from an organization's purchase of energy

- Cruising company: includes GHG emissions that are emitted off-site but for which the company is still responsible

Scope 3 emissions: life cycle emissions that arise across the whole value chain, both upstream and downstream

- Cruising company: the fuel used to power, the energy used to manufacture the materials used to build cruisers and even fumes from the cars the company's employees use to drive to work every day.
- Scope 3 emissions can potentially contribute far more to an organization's overall carbon footprint than the two other scopes

Science-Based Nature Targets (SBTN) for Shipping

- **Zero Conversion:** No conversion of natural habitats, high conservation value areas, or key biodiversity areas from a 2020 baseline
- **Impact Reduction:** Reduction of pollution, invasive species via ballast water, and underwater noise
- **Nature Positive by 2030:** Reverse biodiversity loss by 2030 and ensure full recovery by 2050
- **For cruisers with established and constant routes**
- Immediate decisions to reduce pollution by changing energy source
- Work for reducing underwater noise (electricity provides the first reduction in noise)
- Zero-conversion of coastal habitats and the shift to nature positive by land-use planning, restoration and offsetting. Requires cooperation with ports and cities
- Checking the whole supply chain including the work by subcontractors with respect to biodiversity impacts

Adapted from GHG Protocol: Scopes for biodiversity policy

Scope 1: Direct Impacts on biodiversity (on site)

- **Land Use/Land Use Change**
- **Direct Extraction:** Mining or water extraction from ecosystems on owned land
- **On-site Pollution:** Direct release of chemicals or waste into local soil or water sources that harms nature
- **On-site Disturbance:** Noise or light pollution in sensitive habitats.

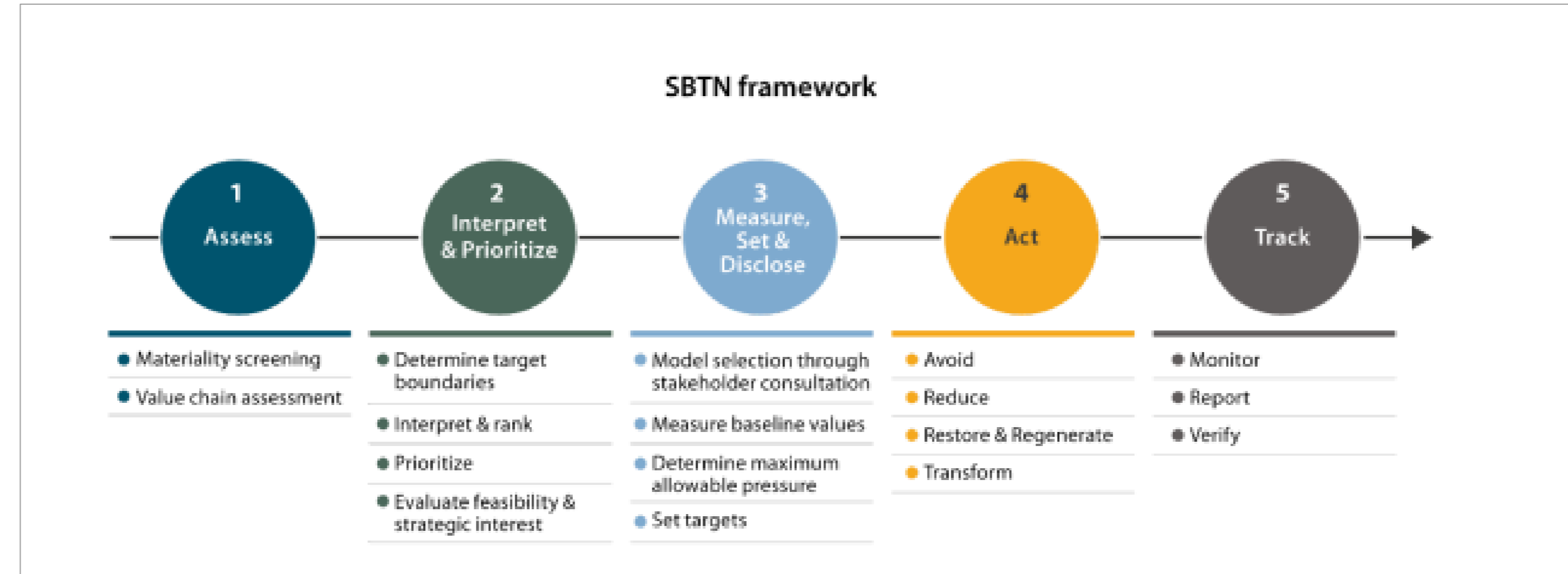
Scope 2: Indirect Impacts from energy Use

- **Energy Infrastructure:** Biodiversity loss associated with the mining of coal, oil and uranium in the electricity purchased
- **Hydroelectric Impacts:** Habitat destruction or fish mortality caused by the upstream hydro plant that supplies the company's electricity

Scope 3: Upstream and Downstream Value Chain Impacts

- Impacts throughout the value chain, both upstream (suppliers) and downstream (product use/disposal) activities
- Scope 3 is often the hardest to track but forms the largest part of a company's total footprint.

Science based targets in practice



Source: [SBTN Guide for Readers_FirstRelease_2023.docx \(sciencebasedtargetsnetwork.org\)](#)

Mandatory policy in practice: shipping & ETS

Shipping will be included in ETS in 2026:

- **EU** starting by 1.1. 2026 and **Britain** by 1.6. 2026 onwards

Key features of ETS (scope 1 emissions)

- Companies must report annual emissions to the registry and surrender emission allowances by that amount
- Reporting is made at the company (not ship) level emissions by a given date each year
- Company Emission Report is based on data verified by an accredited verifier.

Price of CO₂e emissions (EU ETS: average EUA price 74 €/t 2025)

- Emissions trading imposes a price on GHG emissions improving competitiveness of clean energy sources
- Reducing GHG emissions reduces costs from emission allowances

SBTs versus mandatory policy: climate

Emissions trading: obvious advantages

- Helps to reduce emissions from all scopes, 1 – 3 with highest impact on scope 1
- Scope 2 emissions covered by policy: electricity by ETS, road transport by the new ETS2

BUT is ETS too costly?

- Shift to the use of batteries and renewables – eliminates costs from scope 1 emissions altogether
- Upfront costs of batteries are high, but they reduce operational costs over time
- Batteries are here – e.g., Wasa Line between Umeå and Vaasa, Eckerö Line between Helsinki and Tallin

Science based target: advantages

- Better linked to global targets and reduces emissions more if policy makers' climate ambition is low

But can scope 3 emissions be dealt with successfully?

- True challenge, no good answer – on the other hand, ETS does not fully solve this challenge either

SBTs versus mandatory policy: biodiversity

Regulation – advantages

- Difficult to assess, as Europe's biodiversity policy is undeveloped
- No strong economic instruments towards terrestrial and marine environments
- **Nature Restoration Law** promotes restoration projects also on marine environment

SBTN: advantages

At the moment, SBTN offers a more systematic and better approach to biodiversity for shipping

- Restoration of marine environment supports reducing scope 3 impacts

- If restoration policy improves biodiversity in rivers built for electricity production and reduced use of biomass in electricity production, scope 2 and 3 impacts will be reduced

Perhaps the key issue for cruisers is to reduce the underwater noise

Conclusions

Science-based targets and mandatory policy complement each others

- Mandatory policy targets scope1 and also scope 2 impacts

Cruise industry: is becoming a pioneer of sustainability efforts in shipping

- Efficient and affordable means available to achieving zero-carbon targets
- Also means exists to reduce scope 1 impacts on biodiversity but underwater noise requires more attention

SBTi and SBTN: good guidance for the reduction scope 3 impacts

- Improving understanding of scope 2 and scope 3 impacts most likely provides costs savings
- As long as mandatory biodiversity policy remains vague, SBTN helps to collect and direct actions for biodiversity

Cruise Ships of the Future – Sustainability for the Entire Shipbuilding Ecosystem

- Excellent research topic, approach and new results

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