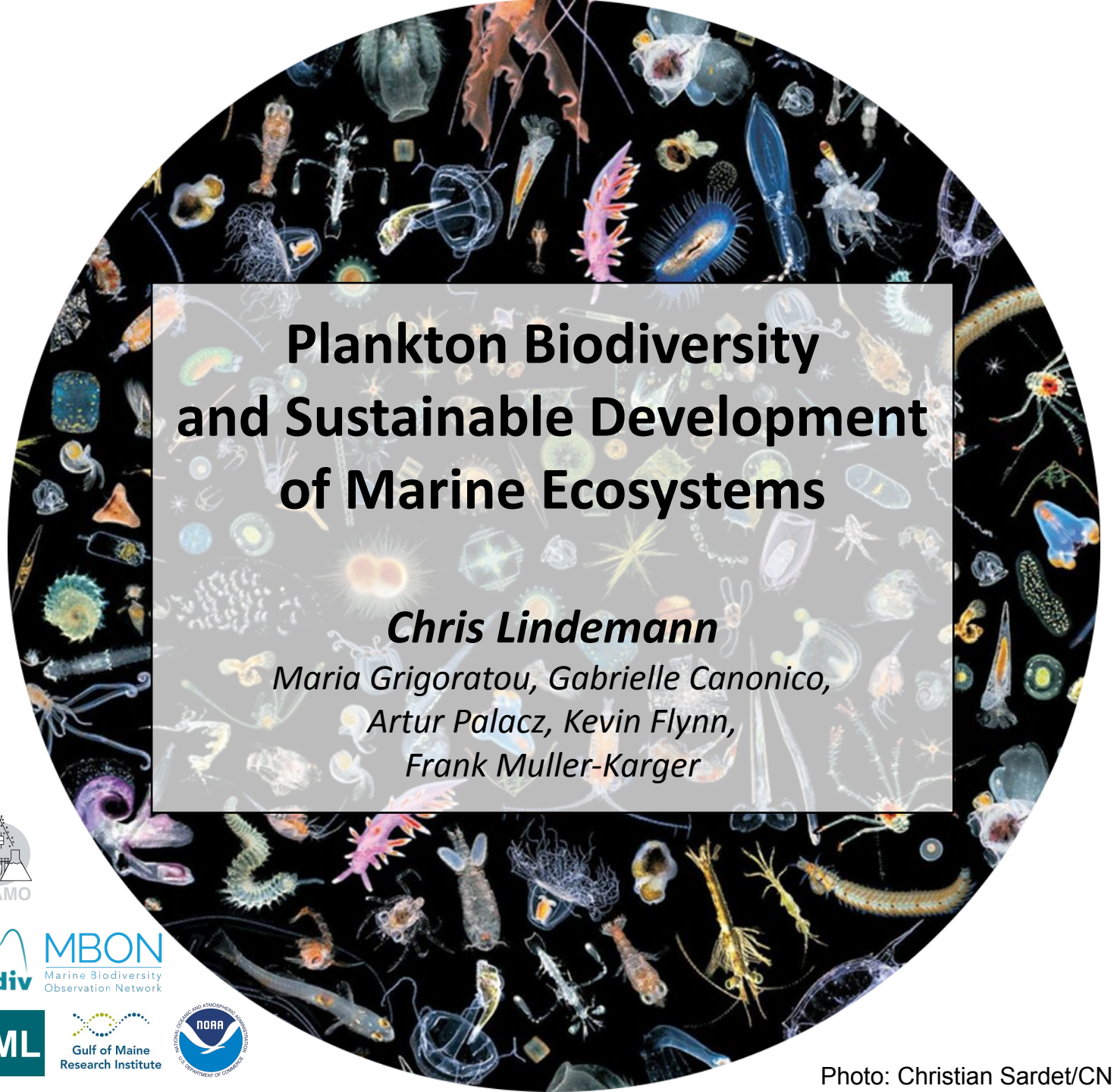


Plankton Biodiversity and Sustainable Development of Marine Ecosystems

Chris Lindemann

Maria Grigoratou, Gabrielle Canonico, Artur Palacz, Kevin Flynn, Frank Muller-Karger

Photo: Christian Sardet/CNRS/Tara Expéditi

Collage of plankton biodiversity that can be found in a drop of water

Photo: Christian Sardet/CNRS/Tara Expéditi

Oxygen production

Tourism

Aquaculture

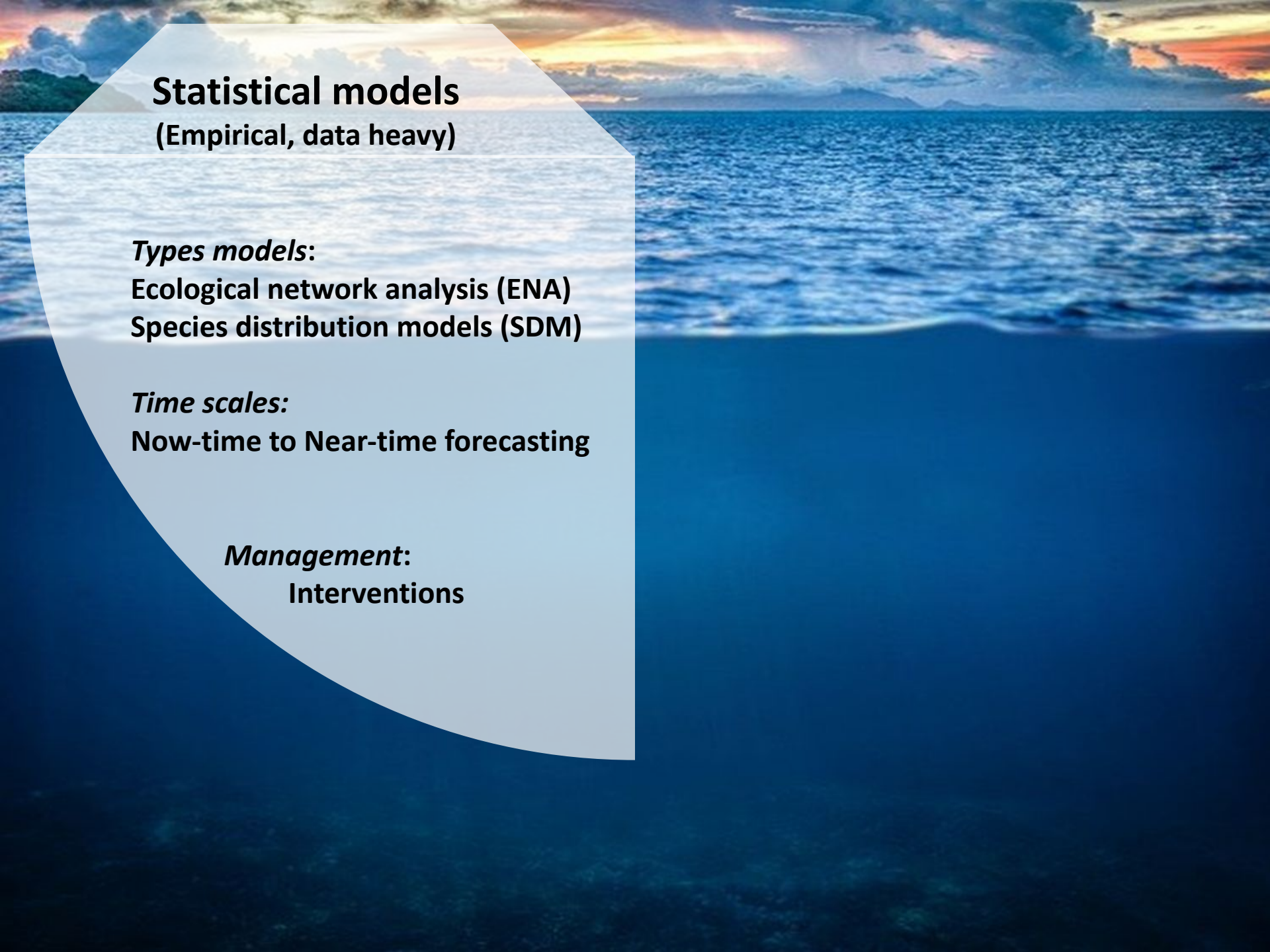
Fisheries

Plankton plays a key role in the marine biogeochemical cycles and food webs, supporting a wide range of ecosystem services.

Harmful Algae Bloom

Carbon sequestration

Unexhausted examples of plankton societal relevance



Statistical models
(Empirical, data heavy)

***Types models*:**
Ecological network analysis (ENA)
Species distribution models (SDM)

Time scales:
Now-time to Near-time forecasting

***Management*:**
Interventions

Statistical models
(Empirical, data heavy)

Types models:
Ecological network analysis (ENA)
Species distribution models (SDM)

Time scales:
Now-time to Near-time forecasting

Management:
Interventions

Process-based models
(Dynamical model with mechanistic underpinning)

Types models:
Ecosystem & Earth-system models

Time scales:
Medium to Long term predictions

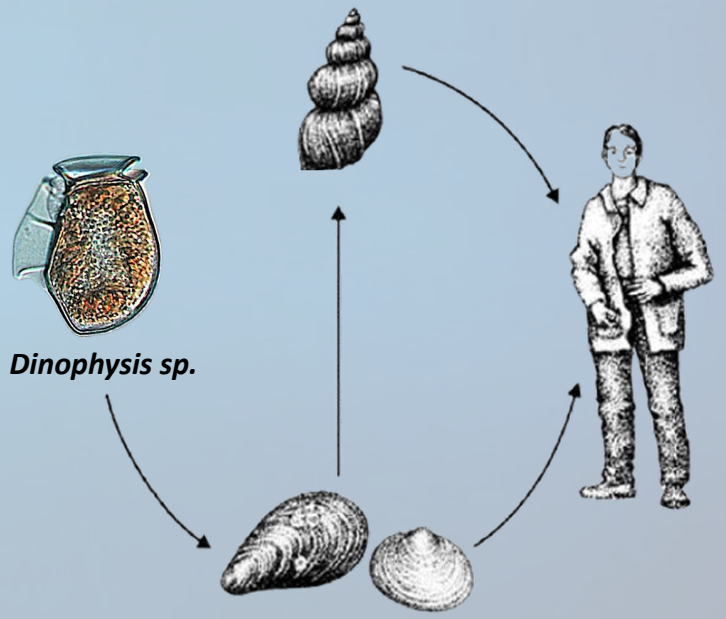
Management:
Management Evaluation
Strategy (MSE)
Advice giving

Statistical models

Process-based models

A challenge: Management-relevant species-level predictability

Example: Forecasting of Harmful Algae Blooms (HABs); Diarrhetic shellfish poising



Statistical models

Process-based models

A challenge: Management-relevant species-level predictability

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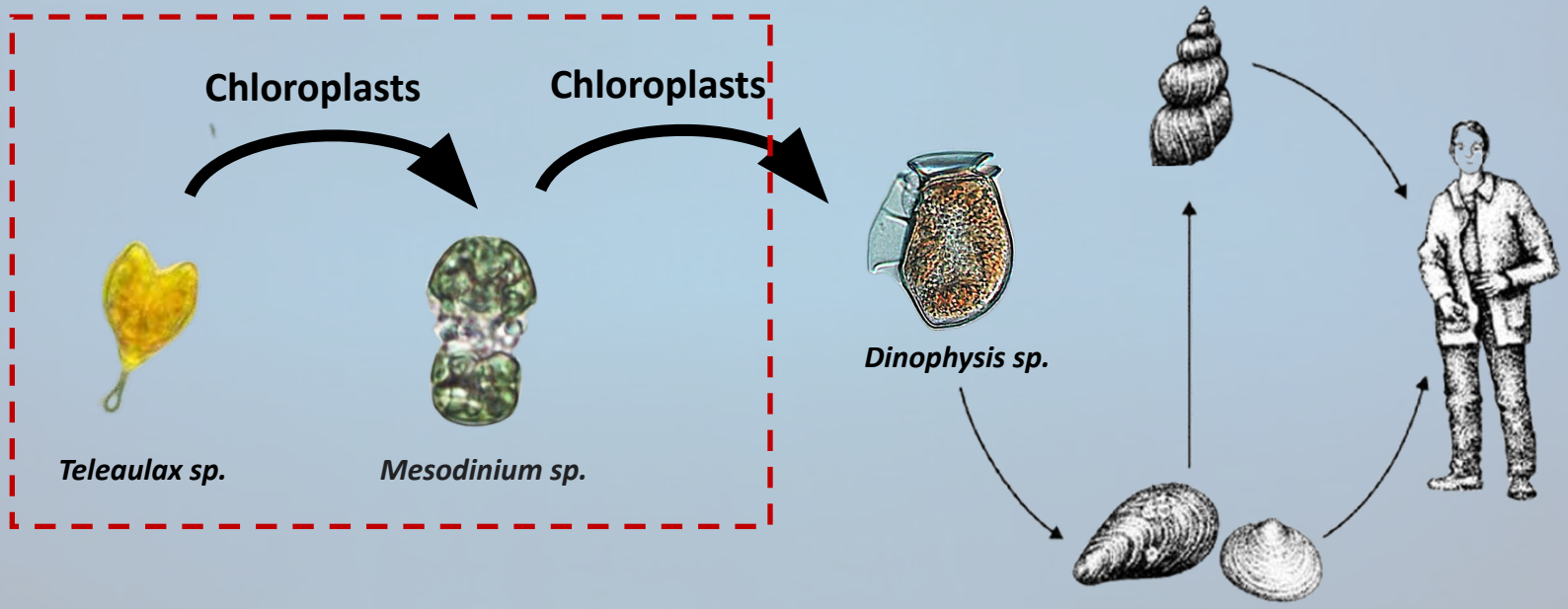

Statistical models

Process-based models

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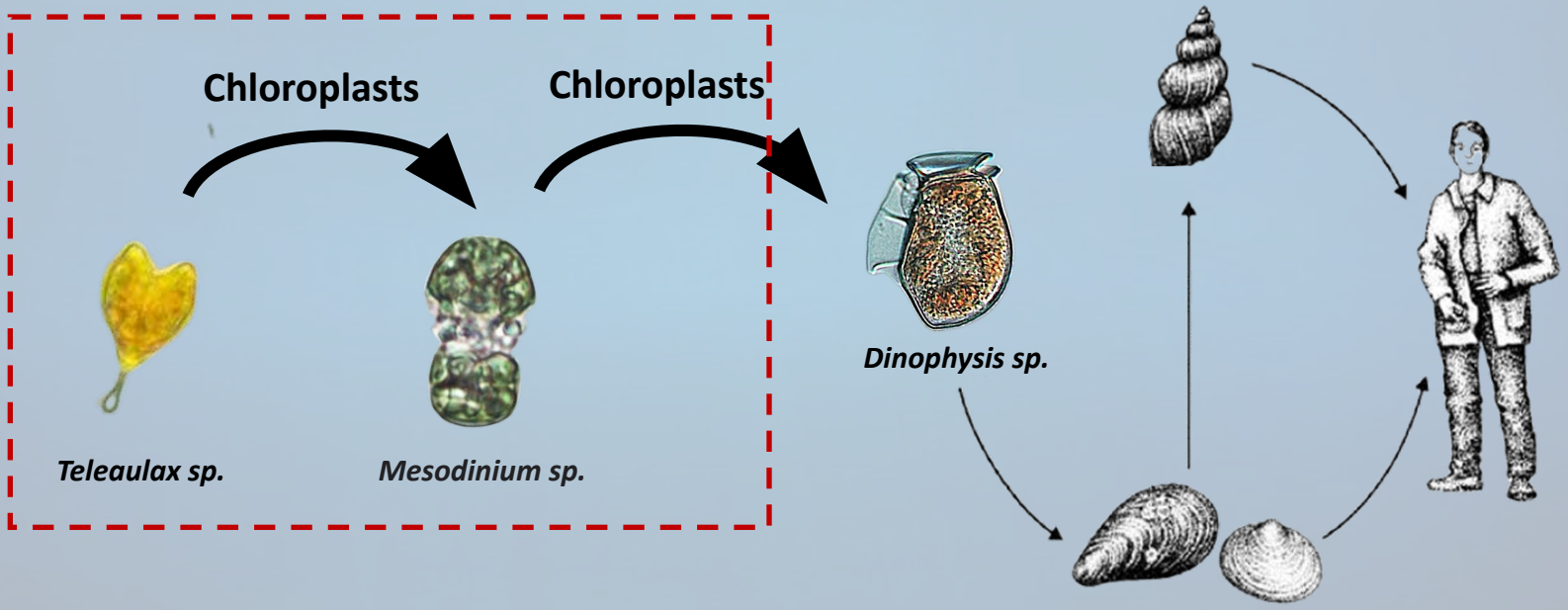


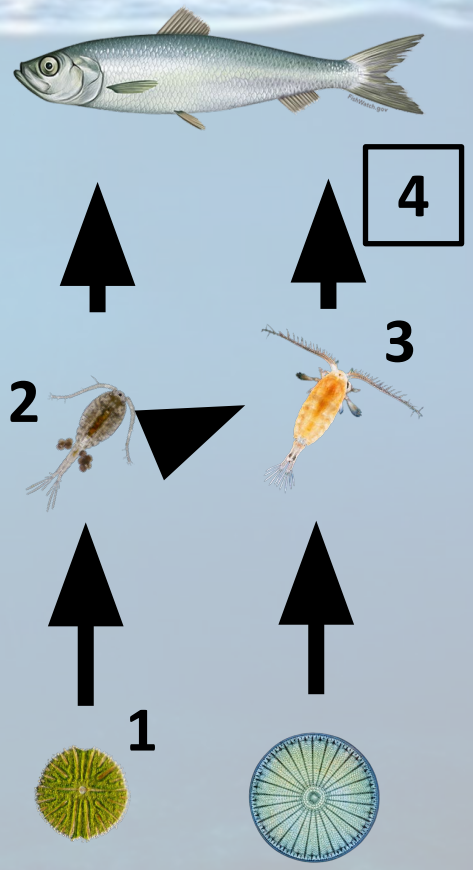
A way forward:
Improve inclusion of species-level functional biodiversity (Autecology)

Statistical models

Process-based models

A challenge: Predictability of ecosystem productivity

Example: Trophic transfer to higher trophic levels in ecosystem models



Statistical models

Process-based models

A challenge: Predictability of ecosystem productivity

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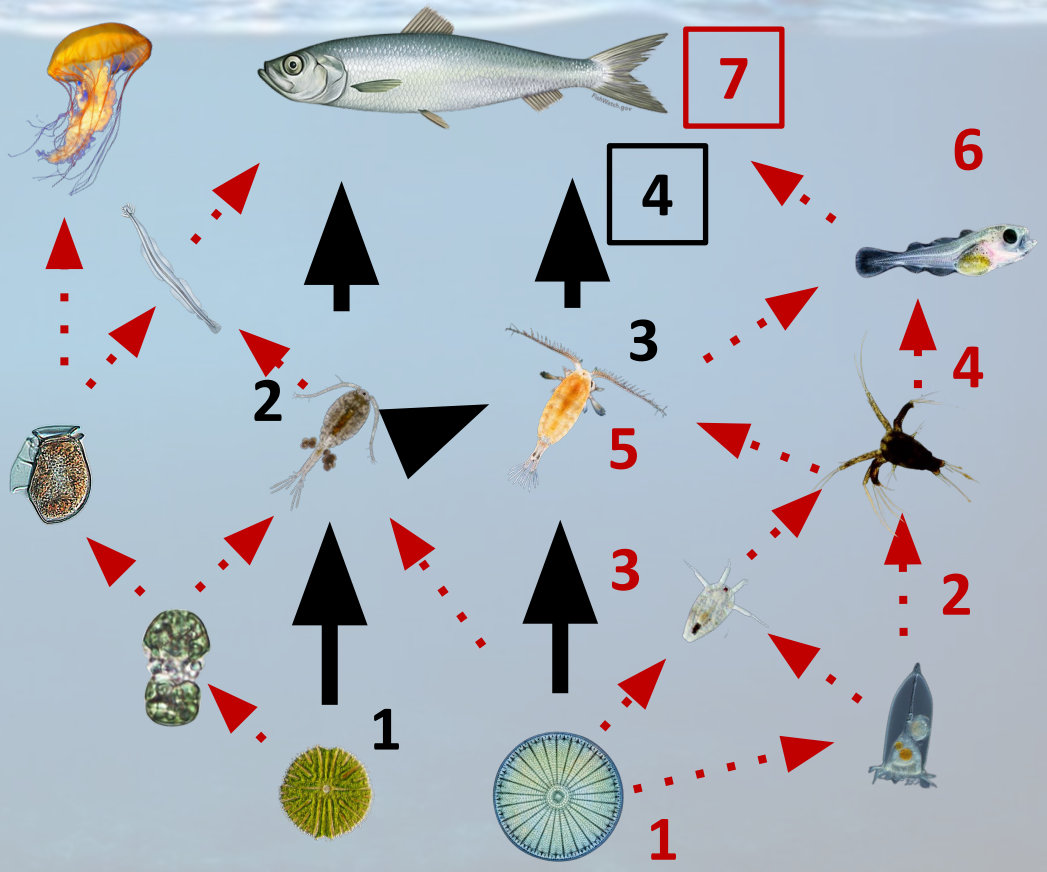

Statistical models

Process-based models

A challenge: Predictability of ecosystem productivity

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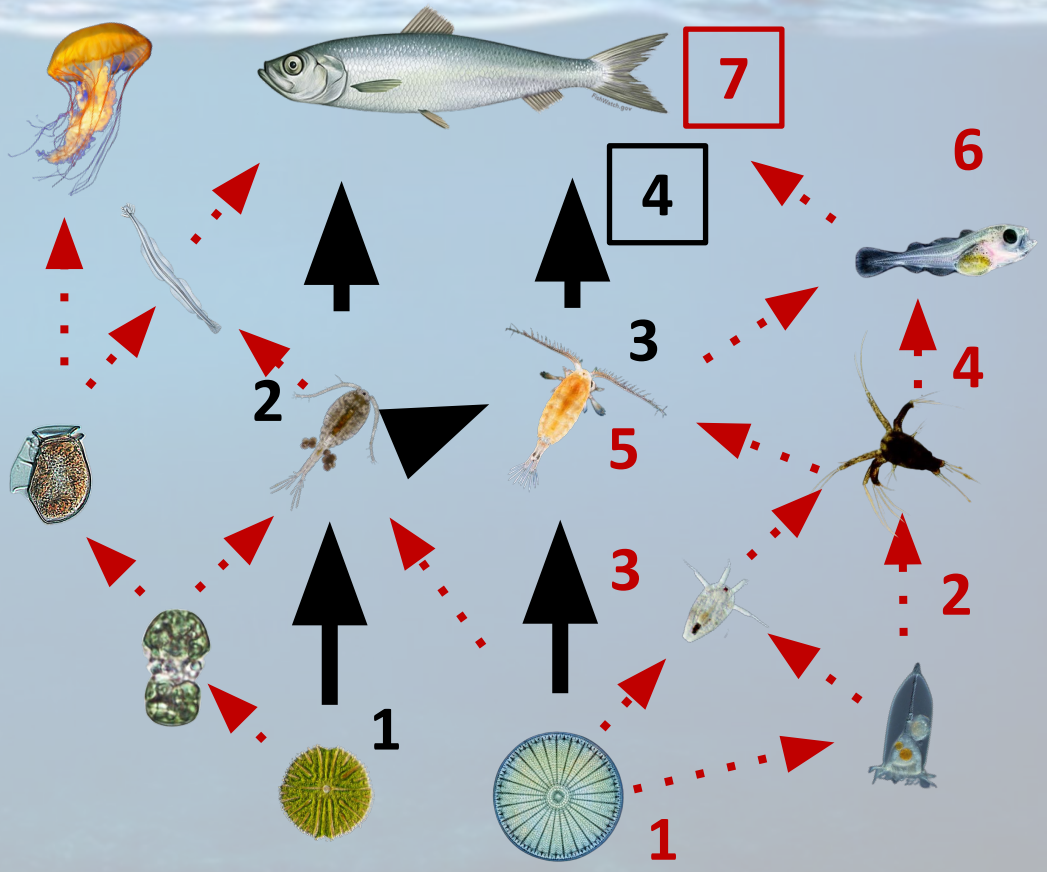

A way forward:
Improve biodiversity representation guided by a better integration of observations

Statistical models

Process-based models

Data needs:

- Standardized observations to capture state and change of biodiversity: **Essential Biodiversity Variables (EBVs)**
- Contextualized observations: **Essentially Ocean Variables (EOVs)** Integrating observations of plankton with physics, chemistry and geology
- Community culture to deposit data in a timely manner into databases (e.g. OBIS), following **FAIR data** principles.

An opportunity
to increase forecasting capabilities

Statistical models

Process-based models

Improve representation of plankton biodiversity

Bridging across scales and scientific communities