Experimental Mitigation and Risk Acceptance:
A case study using seagrass ecosystems –can simple metrics work?

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CSA

Seagrasses

- Rival yield of subsidized crops on a Ha^{-1} basis
- Global Ecosystem Services: *~$1.9 T USD y^{-1}*
  - Productivity, stability, nursery, forage, carbon ↓
- Globally threatened marine habitat
  - 29% lost since 1879
  - 7 % y^{-1} since 1990
- **Not charismatic**

Seagrasses vs. Corals

- **Seagrasses**
  - **Non-charismatic**
  - **Low diversity of simple foundation habitat**
  - **Unappreciated services**
    - ***Carbon sequestration***
    - ***Acidification buffering***
    - ***High associated biodiversity***
  - **~Linear scaling of restored habitat to services**

- **Corals**
  - **Charismatic**
  - **High diversity of complex foundation habitat**
  - **Known services**
    - ***Biodiversity***
    - ***Nursery***
    - ***Tourism***
  - **Non-linear scaling of restored habitat to services**


How important is quantifying associated biodiversity in seagrass restoration?

Net positive impact sequence

Translation to U.S. approach regarding seagrasses

Step 1	Prioritise and select biodiversity features to include	e.g. species x, y and z; ecosystems A and B	***If you build it, they will come..***
Step 2	Select methods to collect data on amounts of each feature in the field	e.g. canopy cover, species abundance	***Acreage and persistence (acre -years of service; AYS)***
Step 3	Convert data into a currency	e.g. Habitat Hectares	***Habitat Equivalency Analysis guides ratio of <u>restored</u> to <u>lost</u> habitat to generate new AYS_d to offset lost AYS_d***
Step 4	Decide on adjustments needed for a fair exchange	e.g. considering ratios, multipliers, time discounting, uncertainty, risk. This is known as an 'exchange mechanism'	***How is this applied?*** • ***"Reasonableness" standard*** • ***$ compliance < non-compliance***

Courtesy J. Ekstrom

ICMM
International Council on Mining & Metals

U.S. Federal approach: Seagrass acreage as a surrogate for all services

As a result – simple surrogate metric of linear AYS_d accepted in federal court ….at what risk?

Worldwide confirmation – numerous peer-reviewed studies:

- ❑ Faunal abundance and diversity scales linearly (and eventually asymptotically) with restoration acreage

- ❑ Restored seagrass beds rapidly take on services of natural beds

Risk issues

- Typical project-level risks (techniques, site, disturbances)
- Performance expectations = crops
- Risk of non-compliance – unreasonable requirements
- Risk of not prevailing in litigation

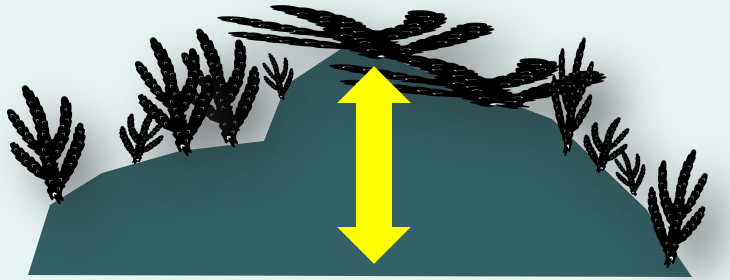
Challenges – Breaking Silos

- Over-the-horizon funding (defensible information)
- Scientists translating to economists, lawyers, regulators
- Building trust

Role of biodiversity in habitat management..

Can simple habitat metrics be applied universally?

- If services scale ~ linearly – **yes.. at project scale**
- If services scale non-linearly – **probably not**



Take – home point:

Simple metrics may represent biodiversity in structurally simple habitats with reasonable risk…

does this scale up to entire landscapes?

Acknowledgements

Robyn Bryant, CSA Ocean Services Inc.
Anne McCarthy, CSA Ocean Sciences Inc.
Robert Mulcahy, CSA Ocean Sciences Inc.
Amy V. Uhrin, Univ. Wisconsin; NOAA/NOS