
ICCS
Imperial College
Conservation Science
Compensatory mitigation for biodiversity: challenges
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Overview

- Introduction
- What is compensatory mitigation?
- Theoretical challenges
- Practical challenges
- Implementation record
- Mitigation in the marine environment
- Conclusions

Introduction

- Compensatory biodiversity legislation in 45 countries, under development in an additional ~30
- Terrestrial biodiversity markets worth >>$4bn per annum (Madsen *et al.*, 2011)
- Compensatory mitigation increasingly important in contemporary conservation
- To date, mainly established in terrestrial environments

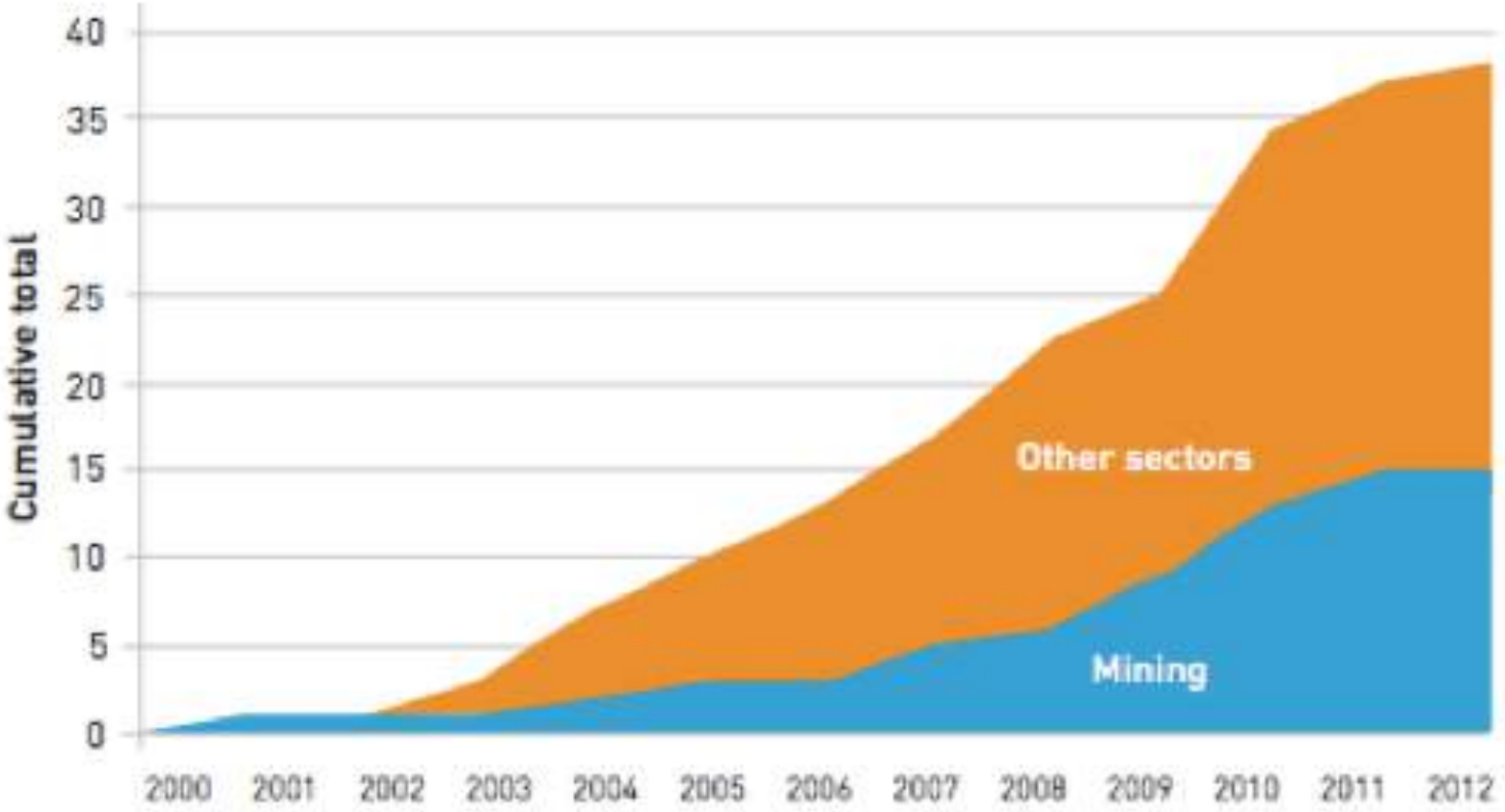
What is compensatory mitigation?

The last step of the 'mitigation hierarchy' after

- Avoidance
- Minimisation

1. Provide **substitution** or **replacement** for **unavoidable** negative impacts of human activity on **biodiversity**
2. Involve **measurable**, **comparable** biodiversity **losses** and **gains**
3. **Demonstrably** achieve **no net loss** of biodiversity

What is compensatory mitigation?



There are currently 38 companies with no net loss-type commitments, including 15 from the mining and aggregates sectors (TBC 2012b).[18]

Challenges

- Despite repeatedly suggesting that it is a good idea in principle…
- …the literature offers numerous hurdles for compensatory mitigation to overcome
- We group these challenges into:
  - *the theoretical*
  - *the practical*

Theoretical challenges

Problem	Description	Relevant research
(a) Currency	Choosing metrics for measuring biodiversity	McKenneny & Kiesecker (2010); Temple *et al.*, (2010); Treweek *et al.* (2010); BBOP (2009a); Norton (2009); Walker *et al.* (2009); Burgin (2008); Chapman & LeJeune (2007); McCarthy et al., (2004); Godden & Vernon (2003); Salzman & Ruhl (2000); Humphries *et al.* (1995)
(b) No net loss	Defining requirements for demonstrating no net loss of biodiversity	Gordon *et al.* (2011); Bekessey *et al.* (2010); McKenneny & Kiesecker (2010); BBOP (2009a); Gorrod & Keith (2009); Gibbons & Lindenmayer (2007)
(c) Equivalence	Demonstrating equivalence between biodiversity losses and gains	Quetier & Lavorel (2011); Burrows *et al.* (2011); McKenneny & Kiesecker (2010); Bruggeman et al (2009, 2005); Norton (2009); Chapman & LeJeune (2007); Gibbons & Lindenmayer (2007); Godden & Vernon (2003)
(d) Longevity	Defining how long offset schemes should endure	McKenneny & Kiesecker (2010); BBOP (2009a); Gibbons & Lindenmayer (2007); Morris *et al.* (2006)
(e) Time lag	Deciding whether to allow a temporal gap between development and offset gains	Gordon *et al.* (2011); Bekessey *et al.* (2010); McKenneny & Kiesecker (2010); Moilanen *et al.* (2009); Norton (2009); Gibbons & Lindenmayer (2007); Morris *et al.* (2006)
(f) Uncertainty	Managing for uncertainties throughout the offset process	Treweek *et al.* (2010); Moilanen *et al.* (2009); Norton (2009)
(h) Reversibility	Defining how reversible development impacts must be	BBOP (2012); Godden & Vernon (2003)
(i) Thresholds	Defining threshold biodiversity values beyond which offsets are not acceptable	BBOP (2012); BBOP (2009a); Norton (2009); Gibbons & Lindenmayer (2007); Morris *et al.* (2006)

- Problems arising in design, potentially resolved through better science…
- …once certain value judgments have been made
- 6 areas for discussion

Theoretical challenges

No Net Loss (NNL)

- NNL of what? Variety or function?
- Metrics: prescriptive or open to interpretation
- Scale: local, regional, national, global
- Baselines: fixed or counterfactual, BAU or No Development

- Genetic variety

- Species variety

- Ecosystem variety

Theoretical challenges

Managing uncertainty

- Identifying sources of uncertainty
- Modeling approaches: e.g. Management Strategy Evaluation
- Tools: Multipliers, Banking mechanisms
- Different economic actors

- Linguistic

- Epistemic

- Human decision

Theoretical challenges

Longevity

- 'In perpetuity' vs. 'as long as development'
- Moving targets: moving PAs, species lifecycle, temporary contracts
- Project financing: insurance, bonds, trust funds, biodiversity banks
- Legislation: covenants, land tenure

- Social change

- Environmental change

- Economic change

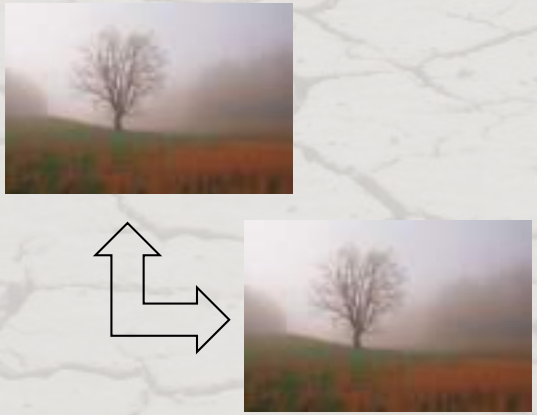
Theoretical challenges

Equivalence

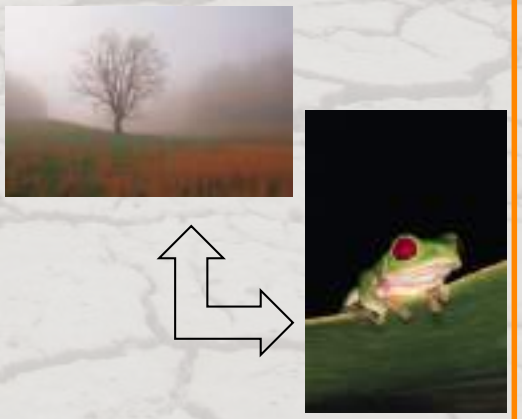
- 'Like for like' vs. 'out of kind'. Economic efficiencies.
- 'Trading up' only? Habitats or species?
- Public to private land?
- Financial compensation = liquefying natural assets?

- Circumstantial

- Standardized



- Correspondence



Theoretical challenges

Thresholds

- Conservation concern
- Residual impact magnitude
- Compensation opportunities
- Feasibility of restoration

- Impacts

- Opportunities

- Feasibility

Theoretical challenges

Restorability

- Sufficient science?
- Proof of implementation?
- Managing uncertainties to avoid spiraling costs
- Time lags: NPV

- Coastal

- Near shore

- High seas

Practical challenges

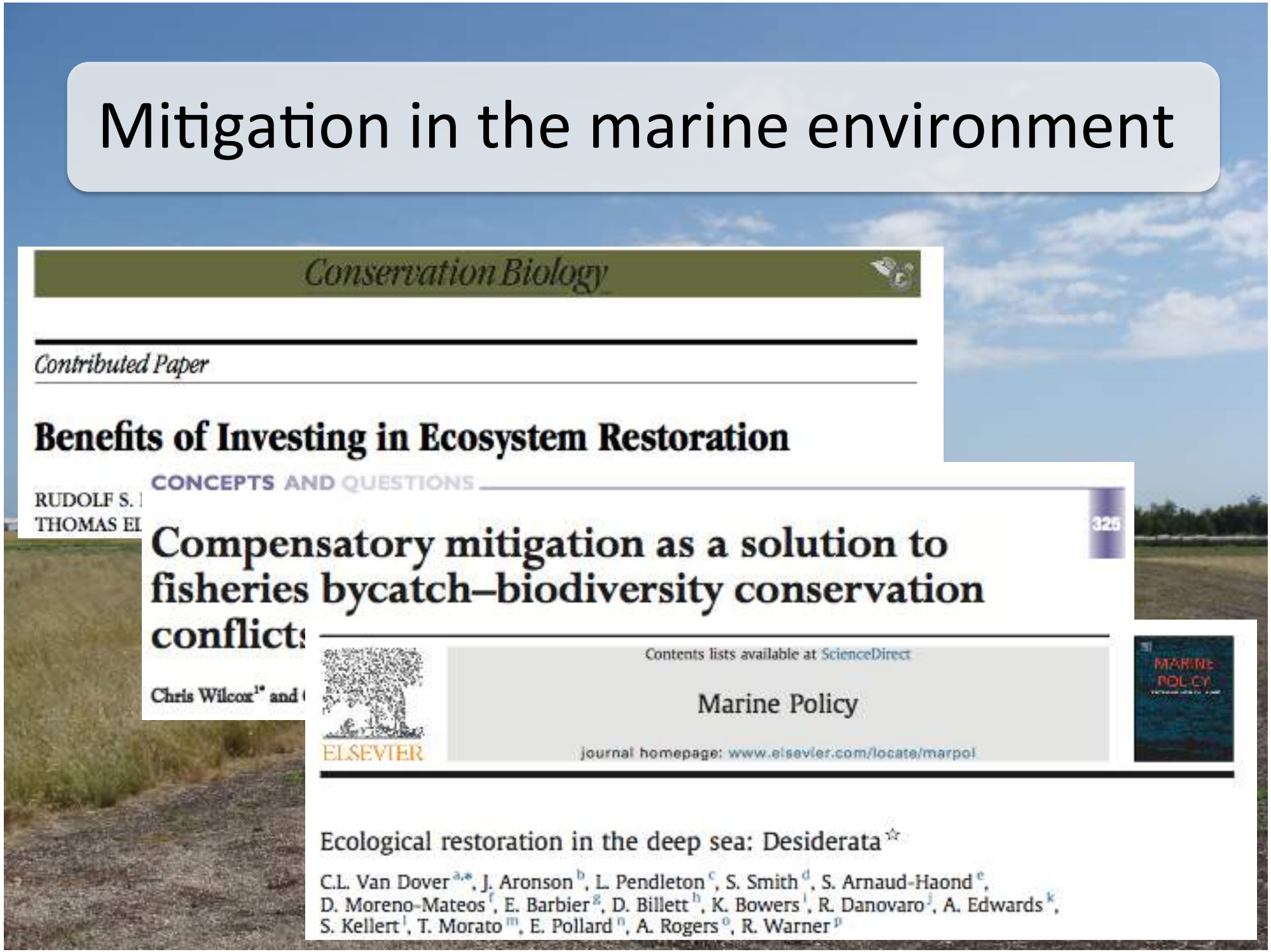
Root problem	Manifestation	Example
(1) Compliance	• Non-compliance with the mitigation hierarchy	Mühlenburger Loch, Germany
	• Insufficient compensation proposed	Mühlenburger Loch, Germany
	• Offsets not implemented, or only partially implemented	Wetland banking, US Fish habitat, Canada
	• Legislation changes during offset scheme	Forest Code, Brazil
(2) Measuring ecological outcomes	• Monitoring different things suggests different ecological outcomes	Wetland banking, US
	• Difference in opinion about ecological outcomes	Basslink project, Australia
	• Outcomes not measured for very long	Fish habitat, Canada
	• Outcomes not monitored at all	Conservation banking, US
	• No follow up by regulator	Conservation banking, US
(3) Uncertainty	• In measurement of biodiversity baseline	Native grassland, Australia
	• In magnitude and type of development impacts	Extractive sector, Uzbekistan
	• Offsets fail to establish or persist	Wetland banking, US
	• Development causes greater impacts than expected	Fish habitat, Canada

- Problems that arise in practice, cannot be resolved through improved science
- Potentially more important than theoretical challenges
- So – how successful have they been in practice?

Implementation record

Related to	Country	Mechanism	Implementation success rates		Sample size	Reference
Compliance, Uncertainty	US	Wetland banking	30 %	of projects meet all project objectives	76 sites	*Matthews & Endress (2008)*
	US	Wetland banking	50 %	of projects fully implemented	23 sites	*Mitsch & Wilson (1996)*
	US	Wetland banking	74 %	of projects achieve no net loss	68 banks	*Brown & Lant (1996)*
	Canada	Fish habitat compensation	12 - 13 %	of projects implemented as required	52 sites	*Quigly & Harper (2006a)*
Monitoring ecological outcomes	Australia	Native vegetation compensation	80 %	reduction in approvals for vegetation clearance	Across New South Wales, Australia	*Gibbons (2010)*
	US (California)	Wetland banking	0 %	of created wetlands were functionally successful	40 sites	*Sudol (1996) in Ambrose (2000)*
	Canada	Fish habitat compensation	37 %	of projects didn't result in a loss of productivity	16 sites	*Quigly & Harper (2006b)*

Mitigation in the marine environment



Conservation Biology

Contributed Paper

Benefits of Investing in Ecosystem Restoration

RUDOLF S.
THOMAS EL

CONCEPTS AND QUESTIONS

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Compensatory mitigation as a solution to fisheries bycatch–biodiversity conservation conflicts

Chris Wilcox[1*] and

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Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

MARINE POLICY

Ecological restoration in the deep sea: Desiderata ☆

C.L. Van Dover [a,*], J. Aronson [b], L. Pendleton [c], S. Smith [d], S. Arnaud-Haond [e], D. Moreno-Mateos [f], E. Barbier [g], D. Billett [h], K. Bowers [i], R. Danovaro [j], A. Edwards [k], S. Kellert [l], T. Morato [m], E. Pollard [n], A. Rogers [o], R. Warner [p]

Conclusions

- Compensatory mitigation not unified by one conceptual framework
- But growing interest in its application in marine systems
- Numerous theoretical challenges to overcome
- Poor success rate to date in implementation
- Potential, but must restrict cases in which we consider mitigation appropriate

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