

How do you determine when rigs to reefs is a suitable decommissioning option?



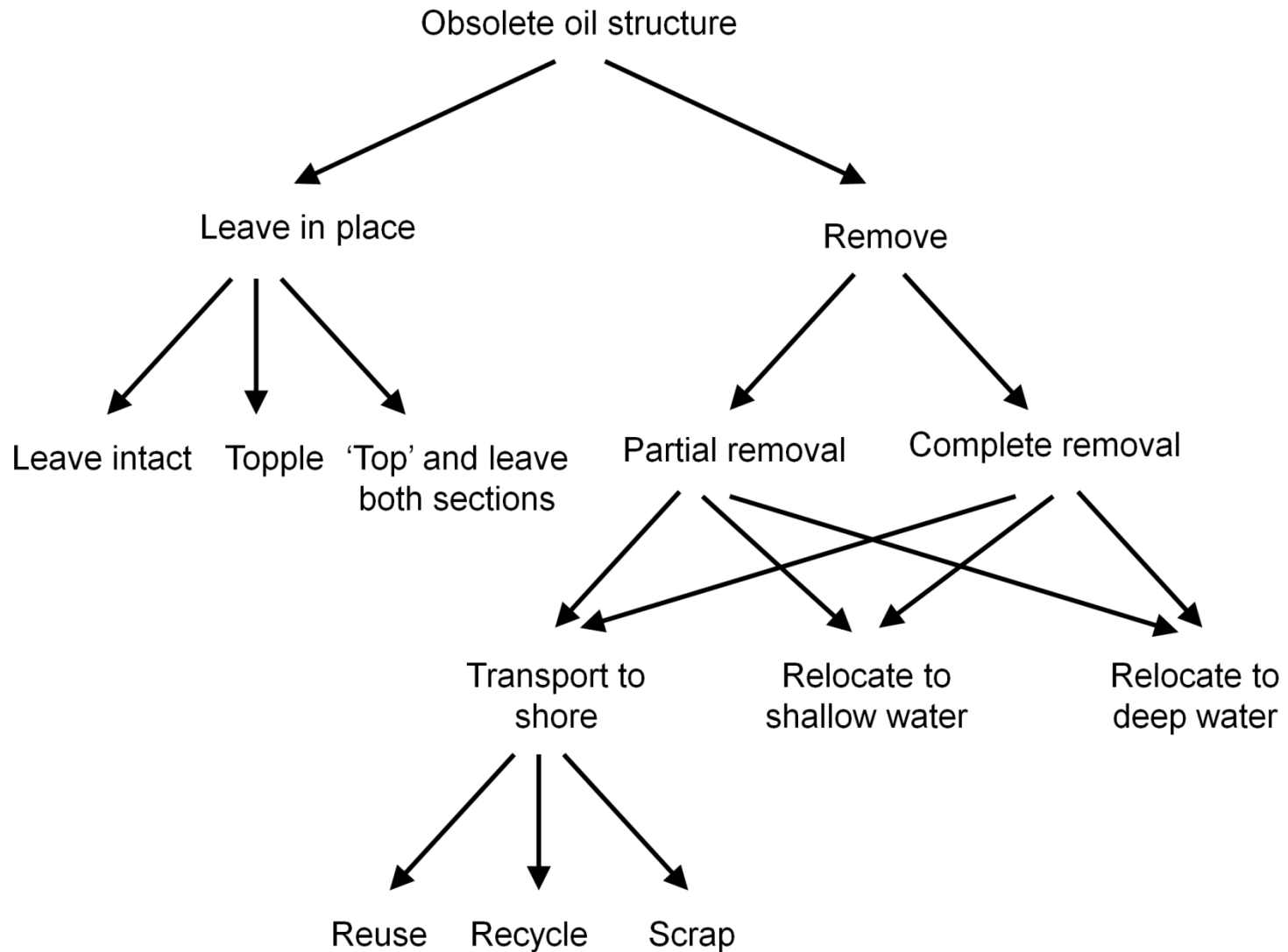
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Decommissioning Ecology Group
University of Technology Sydney (UTS)

Decommissioning decisions

- Range of **options**
- Many considerations
 - cost
 - environmental
 - socioeconomic
 - health and safety
- Very **public and controversial**
 - conflicting stakeholders
- **Difficult to solve unaided**



Decommissioning options



Selection criteria

- 39 criteria
- 5 major areas
- What about logistics?
- Engineering?
- Options vary in performance

Environmental	Financial	Socioeconomic	Health and safety	Additional stakeholder concerns
Energy use	Mobilisation of support vessels	Taxation concessions	Navigation hazards	Commercial fishing access
Gas emissions	Personnel	Employment opportunities	Fishing hazards	Recreational fishing opportunities
Contamination	Onshore processing	Economic stimulus	Crushing accidents	Diving opportunities
Production of exploitable biomass	Landfill	Cultural impingements	Exposure to drilling mud	Clear seabed
Provision of reef habitat	Replacement of construction materials	Public access	Exposure to toxic construction materials	Unobstructed ocean views
Enhancement of diversity	Monitoring of structures left	Public sentiment		
Protection from trawling	Maintenance of structures left			
Spread of invasive species	Liability for property damage			
Loss of the developed community	Liability for personal injury			
Facilitation of disease				
Alteration of trophic webs				
Alteration of hydrodynamic regimes				
Habitat damage from scattering of debris				
Smothering of soft-bottom communities				

Stakeholders

- Wide range of stakeholders
 - Chevron's Gorgon dev.
- Strongly polarized
 - no way to please everyone
- Consultation/involvement **essential to success**

Major stakeholder groups

federal and state ministers and their advisers

federal and state members of parliament

federal and state government agencies

local government representatives

industry and regional development groups

conservation groups

local and regional community groups

indigenous groups

employees and contractors

research centres, including universities

potential customers and suppliers

media and general public

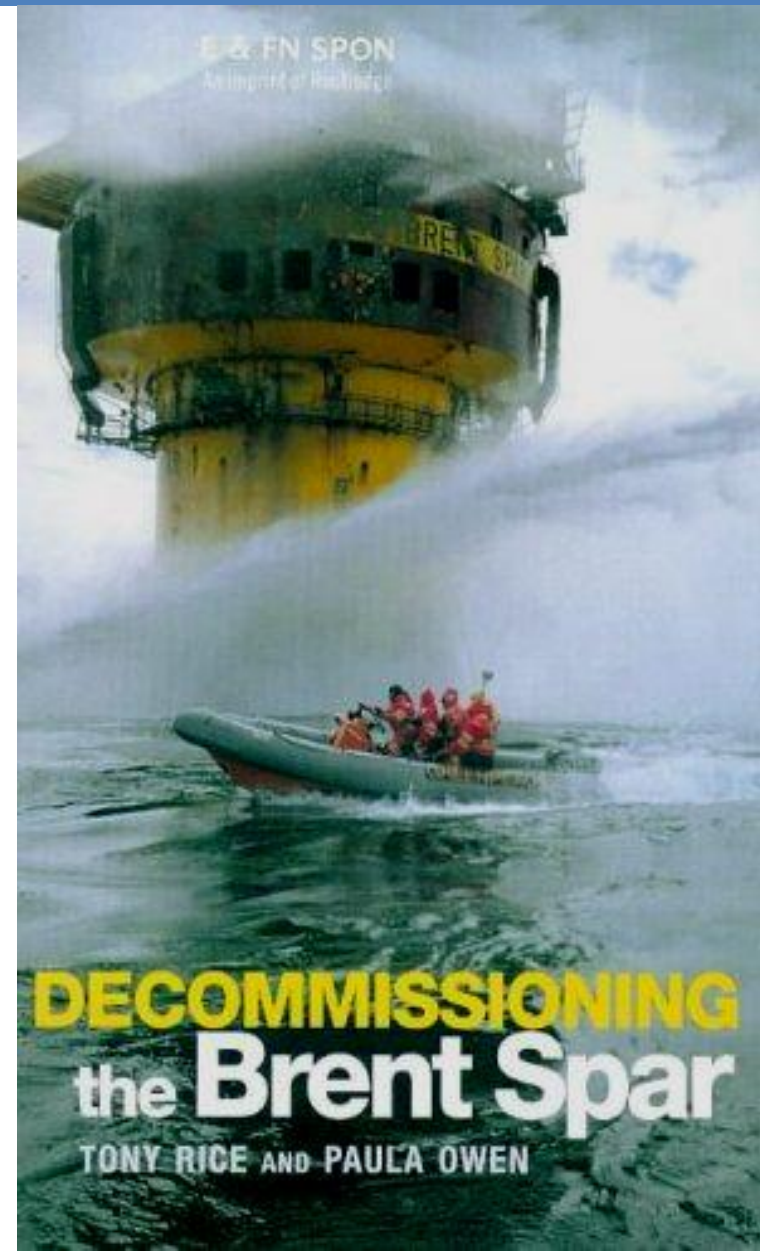
land and lease holders

banking and commercial sector representatives

OIL AND GAS INDUSTRY

Brent Spar controversy

- Oil storage buoy in Nth Sea
 - production ceased 1991
- **Deep-sea disposal** preferred:
 - fewer safety risks
 - technically more simple
 - cheaper
- Worldwide media campaign launched by Greenpeace
- **Brent Delta** – extensive and transparent consultation



Decision science

- Dedicated to **solving complex decisions**
 - incorporates many criteria
 - can handle many options
- Recognises failures of heuristic decisions
 - judgement and experience can only go so far
- **Optimises trade-offs**
- Widely used for **environmental decision-making**
 - water and waste management
 - FORESTRY

Decommissioning decisions - our approach

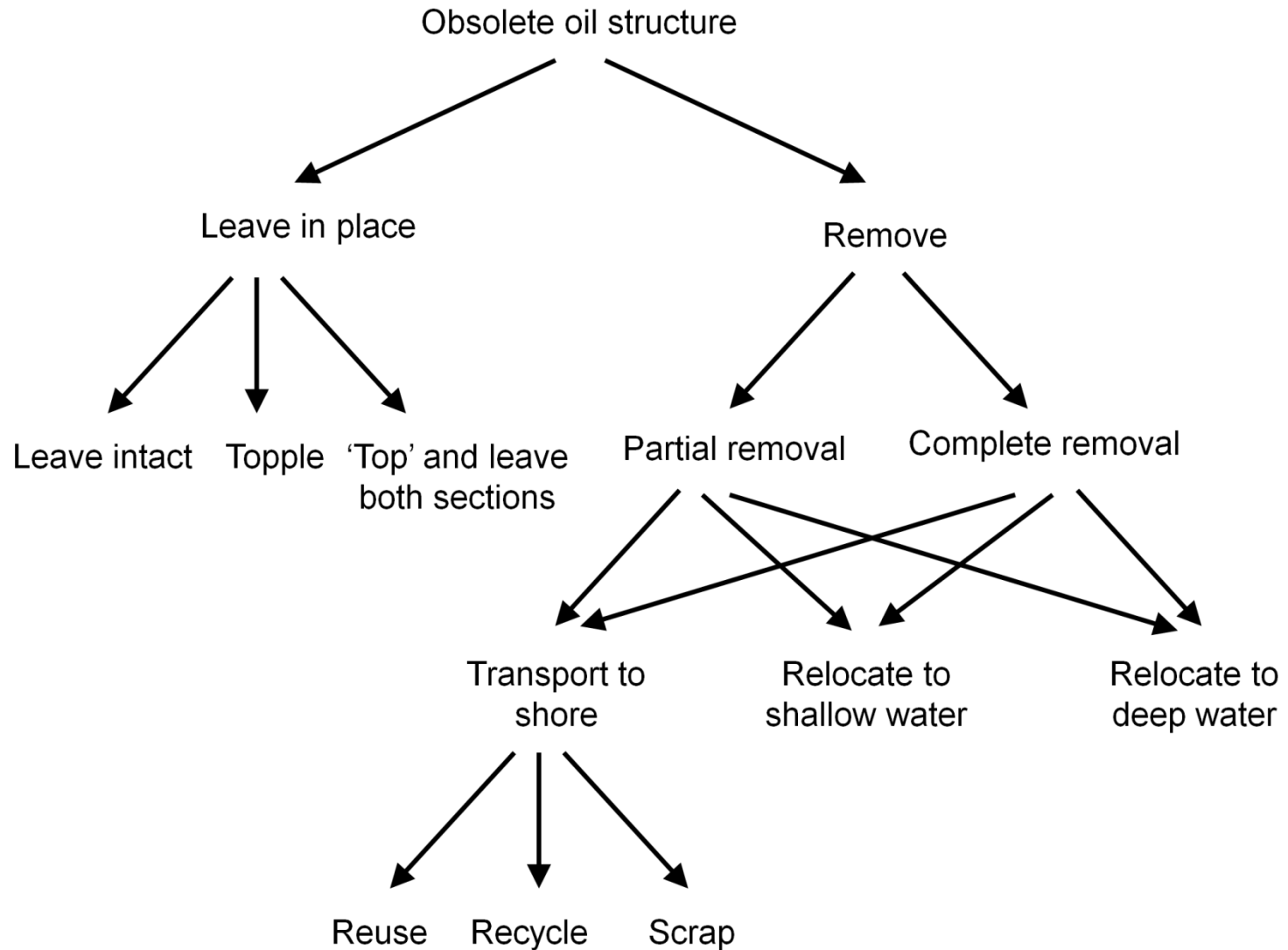
- Multi-criteria decision analysis based on voting theory
 - **optimises complex trade-offs**
- Based on **expert evaluations**
 - deals with the issue of scant data, e.g. environmental
- **Stakeholders directly involved** in decision process
 - reduces suspicion
- Relatively **rapid and transparent** outcomes

Step 1 - Decommissioning options

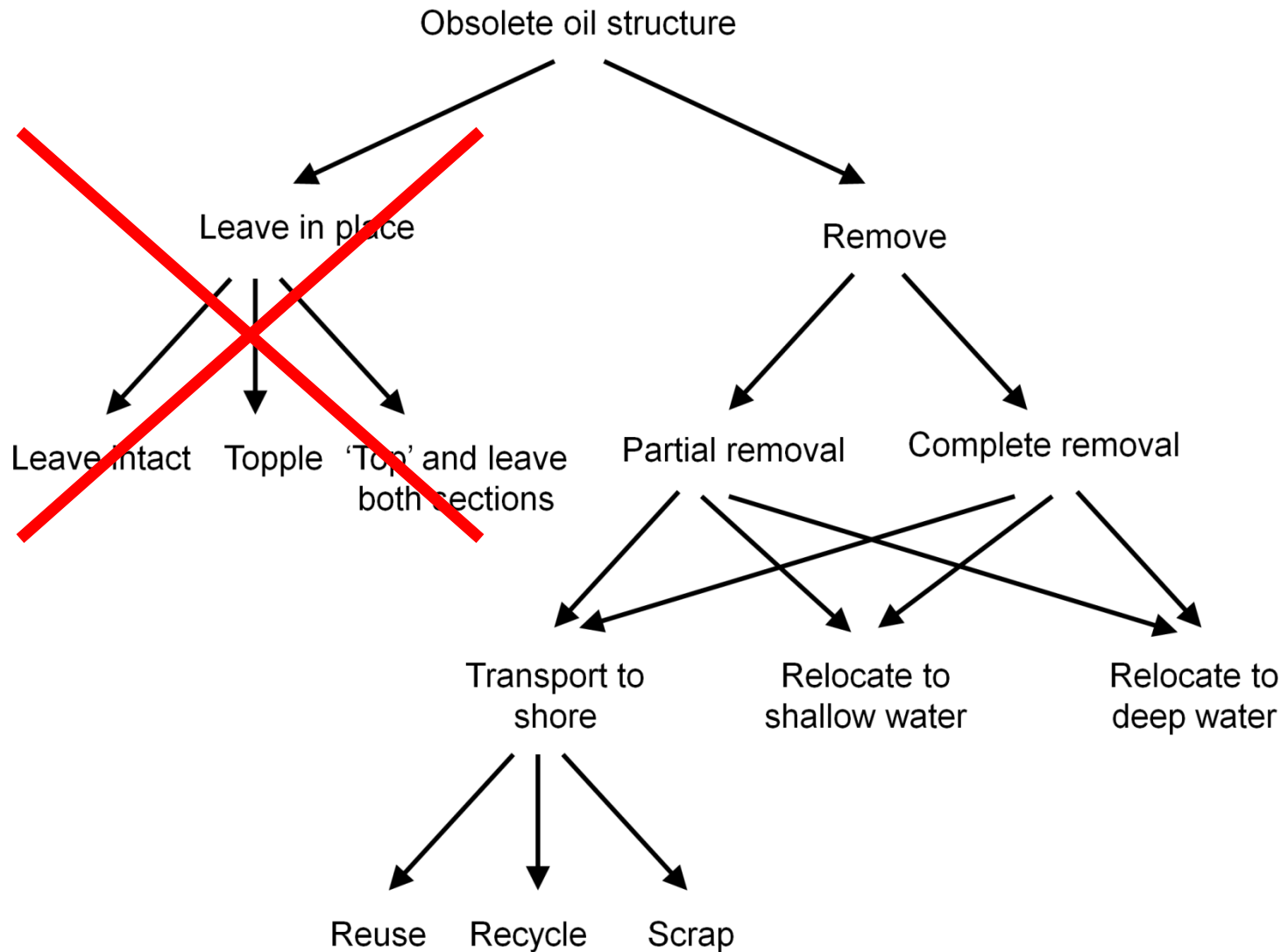
- Depend on regulatory env.
 - can be extremely restrictive
- Options may vary greatly
- Options can be added/subtracted easily
- **NEW SYSTEM:**
Include **all possible options**



Options hierarchy



Regulatory restrictions



Step 2 - Identifying criteria

- Stakeholder workshops
- Use stakeholders to ID criteria - repeated assessment
- These will vary among scenarios
- Just add and subtract as required

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Protection from trawling	Maintenance of structures left			
Spread of invasive species	Liability for property damage			
Loss of the developed community	Liability for personal injury			
Facilitation of disease				
Alteration of trophic webs				
Alteration of hydrodynamic regimes				
Habitat damage from scattering of debris				
Smothering of soft-bottom communities				

Step 3 - Criteria importance

- Stakeholders each **rank criteria** on importance
- Ranks will vary greatly
- fishers vs. conservation
- Equal-weighted averaging?
- **KEY: everyone has their say**

Environmental criteria	Rank
Energy use	2
Gas emissions	1
Contamination	6
Production of exploitable biomass	4
Provision of reef habitat	7
Enhancement of diversity	8
Protection from trawling	3
Spread of invasive species	9
Loss of the developed community	5
Facilitation of disease	9
Alteration of trophic webs	9
Alteration of hydrodynamic regimes	12
Habitat damage from scattering of debris	13
Smothering of soft-bottom communities	14

Step 4 - Performance evaluations

- Use experts **familiar with location/region**
 - quality information
- Multiple experts per field
 - reduces potential bias
 - preferably use **independent experts**
- Use **ranks** rather than 'scores'
 - ranks deal with uncertain data, hard data still useable
 - ranks averaged to reach consensus
- **Email or secure online system**
 - reduce cost and time

Evaluation example

	Leave in place intact	Topple in place	Top' and leave both sections	Partially remove, transport to shore, reuse	Partially remove, transport to shore, recycle	Partially remove, transport to shore, scrap	Partially remove, relocate to shallow water	Partially remove, relocate to deep water	Completely remove, transport to shore, reuse	Completely remove, transport to shore, recycle	Completely remove, transport to shore, scrap	Completely remove, relocate to shallow water	Completely remove, relocate to deep water
Energy use	3	4	4	1	2	8	7	7	5	6	10	9	9
Gas emissions	1	2	3	5	5	5	4	4	7	7	7	6	6
Contamination	1	5	2	6	6	6	5	4	9	9	9	8	7
Production of exploitable biomass	1	4	2	3	3	3	2	2	6	6	6	5	5
Provision of reef habitat	1	6	3	5	5	5	2	4	9	9	9	7	8
Enhancement of diversity	1	6	3	5	5	5	2	4	9	9	9	7	8
Protection from trawling	3	3	3	3	3	3	1	2	6	6	6	4	5
Spread of invasive species	1	2	2	7	7	7	4	3	8	8	8	6	5
Loss of the developed community	1	6	2	5	5	5	3	4	9	9	9	7	8
Facilitation of disease	1	2	2	7	7	7	4	3	8	8	8	6	5
Alteration of trophic webs	5	3	4	2	2	2	8	7	1	1	1	7	6
Alteration of hydrodynamic regimes	8	4	5	2	2	2	6	3	1	1	1	7	3
Habitat damage from scattering of debris	2	8	5	3	3	3	6	4	1	1	1	9	7
Smothering of soft-bottom communities	1	5	4	2	2	2	4	4	3	3	3	6	6

Step 5 - Multi-criteria approval

- Options are ‘approved’ and ‘disapproved’ for each criterion
 - based on performance threshold
- Option with the **highest number of important approvals** is selected
- Relatively **simple to calculate**
 - easy to understand
 - easy to double-check
 - not a ‘black box’

'Approvals' example

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Energy use	1	1	1	1	1	0	1	0	0	0	0	0	0
Gas emissions	1	1	1	1	0	0	1	1	0	0	0	0	0
Contamination	1	1	1	1	0	0	0	0	0	0	0	0	1
Production of exploitable biomass	1	1	1	0	0	0	1	1	0	0	0	1	0
Provision of reef habitat	1	1	1	0	0	0	1	0	0	0	0	1	0
Enhancement of diversity	1	1	1	0	0	0	1	1	0	0	0	1	0
Protection from trawling	1	1	1	0	0	0	1	0	0	0	0	1	0
Spread of invasive species	1	1	1	0	0	0	1	0	0	0	0	0	0
Loss of the developed community	1	1	1	0	0	0	1	1	0	0	0	0	0
Facilitation of disease	1	1	1	0	0	0	1	1	0	0	0	0	0
Alteration of trophic webs	1	1	1	0	0	0	1	0	0	0	0	0	0
Alteration of hydrodynamic regimes	1	1	1	0	0	0	0	0	1	1	1	0	0
Habitat damage from scattering of debris	1	0	0	1	1	1	0	0	0	0	0	0	0
Smothering of soft-bottom communities	1	0	0	0	0	0	0	0	1	1	1	0	0

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Case study – platform off sth Cal

- 97 m in Santa Barbara Channel
- Our assessment:
Leave in place intact
- Supports large rockfish population
- Popular fishing and dive site



Approvals data

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Contamination	1	1	1	1	0	0	0	0	0	0	0	0	1
Production of exploitable biomass	1	1	1	0	0	0	1	1	0	0	0	1	0
Provision of reef habitat	1	1	1	0	0	0	1	0	0	0	0	1	0
Enhancement of diversity	1	1	1	0	0	0	1	1	0	0	0	1	0
Protection from trawling	1	1	1	0	0	0	1	0	0	0	0	1	0
Spread of invasive species	1	1	1	0	0	0	1	0	0	0	0	0	0
Loss of the developed community	1	1	1	0	0	0	1	1	0	0	0	0	0
Facilitation of disease	1	1	1	0	0	0	1	1	0	0	0	0	0
Alteration of trophic webs	1	1	1	0	0	0	1	0	0	0	0	0	0
Alteration of hydrodynamic regimes	1	1	1	0	0	0	0	0	1	1	1	0	0
Habitat damage from scattering of debris	1	0	0	1	1	1	0	0	0	0	0	0	0
Smothering of soft-bottom communities	1	0	0	0	0	0	0	0	1	1	1	0	0

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Sensitivity analysis and limitations

- **Result robust to systematic variation**
 - no effect of weighting changes
 - top option resistant to rank decreases
 - second options resistant to rank increases

- **Limited trial**
 - based on env criteria only
 - limited expert pool
 - not regional experts

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Contamination	1	1	1	1	0	0	0	0	0	0	0	0	1
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Provision of reef habitat	1	1	1	0	0	0	1	0	0	0	0	1	0
Enhancement of diversity	1	1	1	0	0	0	1	1	0	0	0	1	0
Protection from trawling	1	1	1	0	0	0	1	0	0	0	0	1	0
Spread of invasive species	1	1	1	0	0	0	1	0	0	0	0	0	0
Loss of the developed community	1	1	1	0	0	0	1	1	0	0	0	0	0
Facilitation of disease	1	1	1	0	0	0	1	1	0	0	0	0	0
Alteration of trophic webs	1	1	1	0	0	0	1	0	0	0	0	0	0
Alteration of hydrodynamic regimes	1	1	1	0	0	0	0	0	1	1	1	0	0
Habitat damage from scattering of debris	1	0	0	1	1	1	0	0	0	0	0	0	0
Smothering of soft-bottom communities	1	0	0	0	0	0	0	0	1	1	1	0	0

Sensitivity analysis and limitations

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Benefits of the approach

- Results in **holistic** decommissioning decisions
- **Conservative**
 - unlikely to select extreme options
- **Defensible**
 - provides an objective case for environmental plans
- **Identifies areas of conflict** early in the process
- **Transparent** for stakeholders
 - minimise controversy following a decision
- **Adaptable** to different scenarios

Moving forward - working with industry

- Refine options and criteria lists - ENGINEERING
 - **Maximise usefulness for industry**
 - trial the approach
 - identify weaknesses
 - fine-tune stakeholder engagement
 - Need for **further decision research**
 - balance preferences of major Australian stakeholders
- * **UTS Centre for Choice**, world leaders in decision research

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