Enhancing the Understanding of the Value Provided to Fisheries by Man-Made Aquatic Structures

FRDC 2018-053

Curtin University

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FRDC
FISHERIES RESEARCH & DEVELOPMENT CORPORATION

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Project Objectives

1) Augment and integrate analytical methods to identify and explore the socio-economic values of man-made marine structures in Western Australia.
2) Collate a list and description of the man-made marine structures in the marine environment in Western Australian and the associated social, economic and biodiversity data.
3) Collect and collate data on the social and economic values of man-made marine structures in Western Australia including five case studies.
4) To develop a framework for undertaking socio- economic evaluations of man-made marine structures which can be used throughout Australia and guide end users depending on their information requirements.

What are man-made marine structures?

- Jetties
- Groynes
- Break walls
- Structures associated with harbours
- Boat ramps
- Marine navigation aids
- Shipwrecks
- Artificial reefs
- Oil and gas infrastructure
  - Platforms
  - Pipelines
  - Wellheads

- Recreation
  - Fishing (Land and boat based)
  - Scuba diving and snorkelling
  - Swimming
  - Walking
- Tourism
  - Exmouth Navy Pier
  - Busselton Jetty
- Commercial fishing
  - Charter Boats
  - Aquaculture
  - Finfishing
  - Future developments?

Number of structures in WA waters

7400+

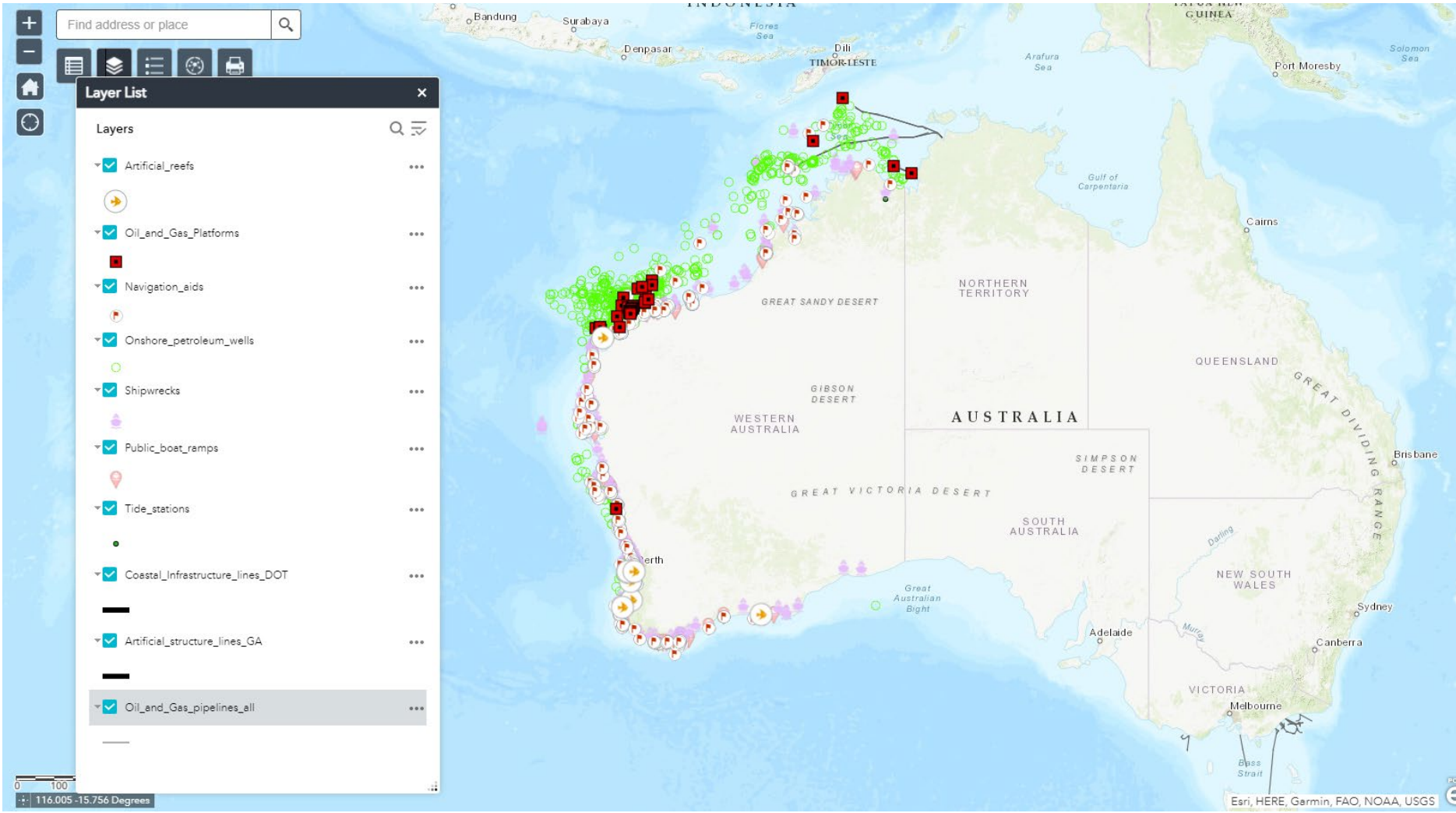
Ariel Neri

Laura Fullwood

Ben Radford

Googlesheet

- Ecological
- Social
- Economic
- Structure



Objective 2

Case Studies

1) Exmouth Integrated Artificial Reef
2) Thevenard Island Inshore Oil and Gas Infrastructure
3) Echo Yodel Offshore Oil and Gas Infrastructure
4) Exmouth Navy Pier
5) Busselton Jetty

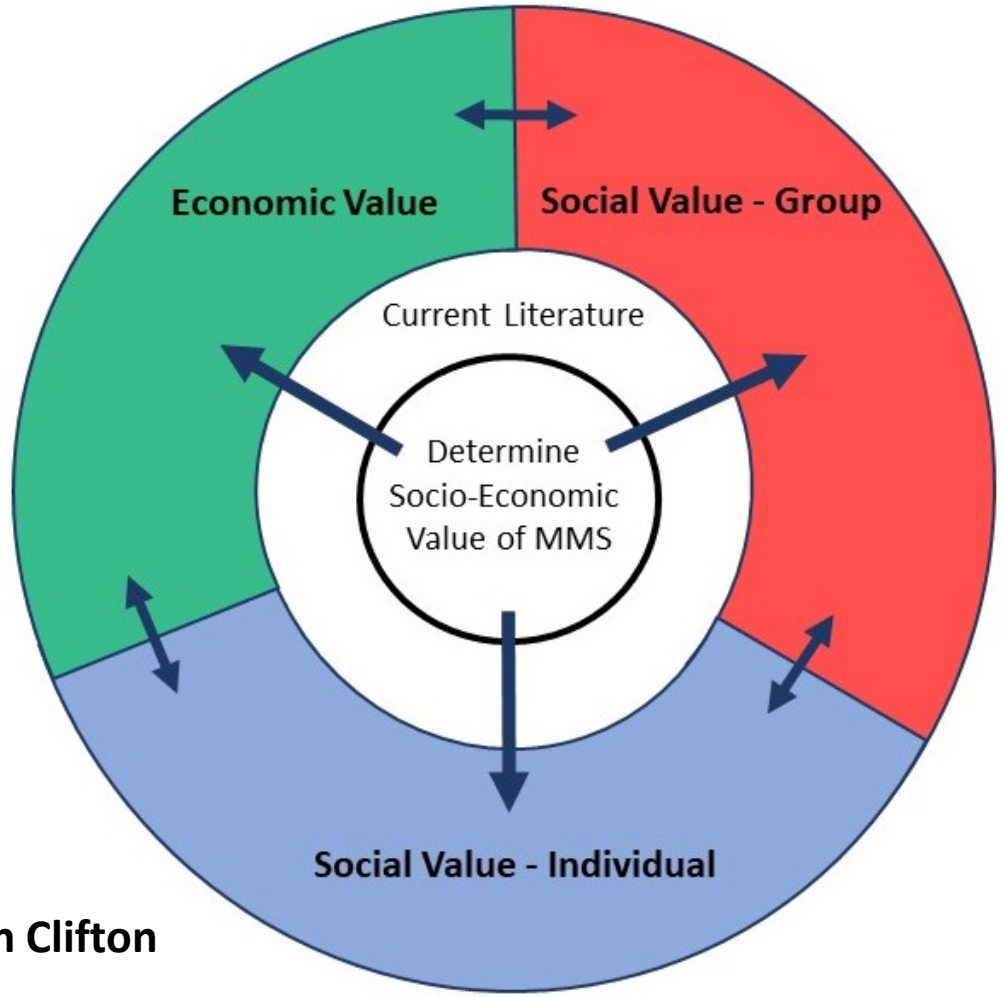
Purpose

Provides examples of user/structure type specific information

Demonstration of the value of different types of data collection and analysis and the outputs

Structure of presentation

1. Michael Burton



3. Fran Ackermann

2. Julian Clifton

ECONOMIC VALUES

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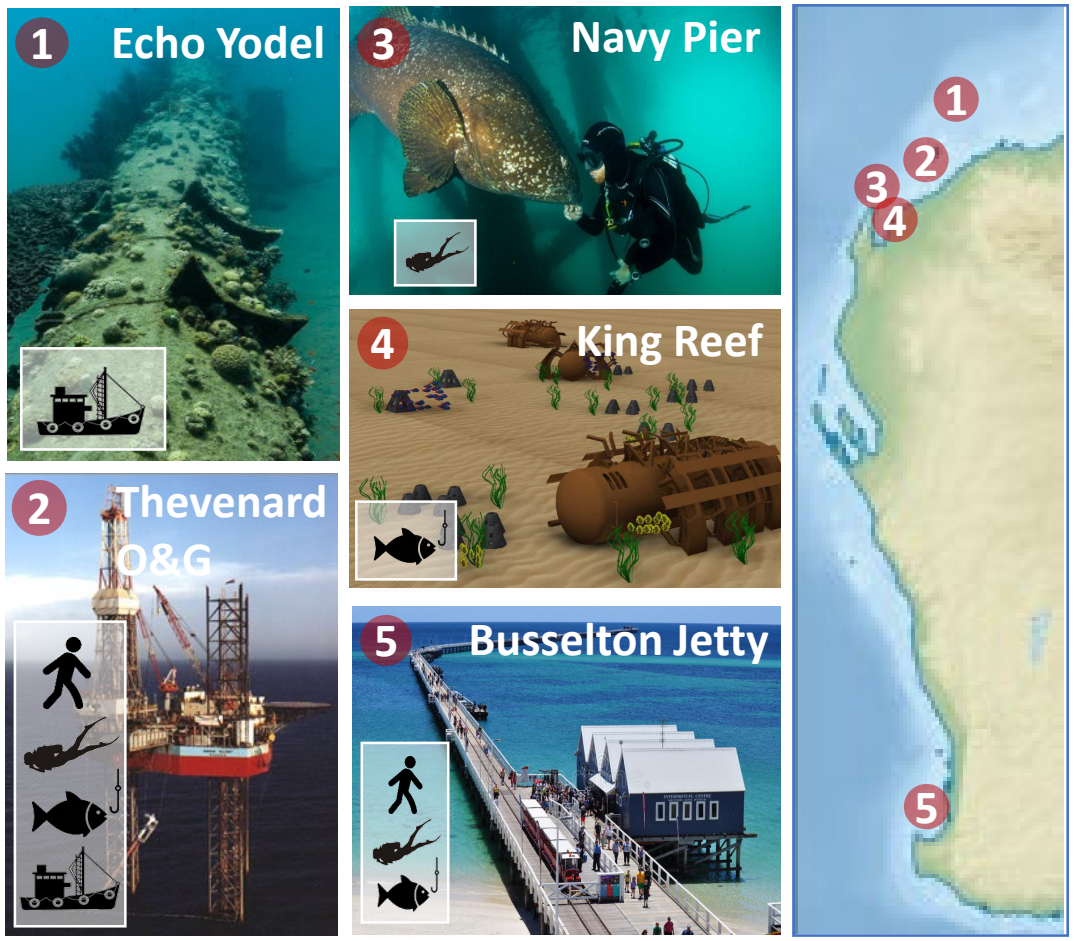
Economic Values: Objectives

- Evaluate economic values of MMS
  - In different contexts (case studies)
  - For different stakeholder groups
  - Using different economic techniques of varying complexity

- Assess benefits and shortcomings of each approach



Economic Value Types

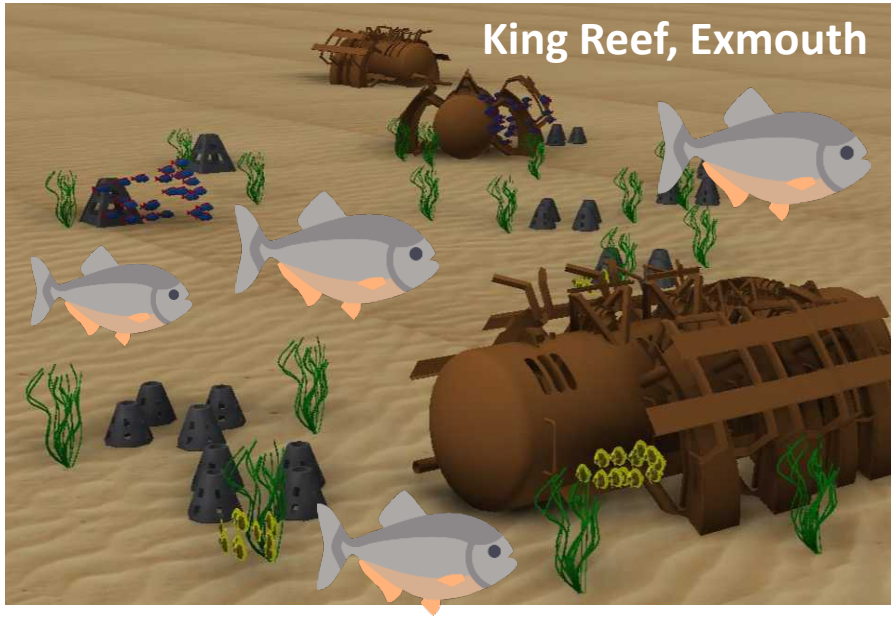
Economic Values of MMS		
Use Values	**Community Values**	**Environmental Values**
Values arising from the immediate use of a marine man-made structure in the form of outputs that can be consumed or enjoyed directly *Examples:* Extractive use (e.g. welfare from recreational fishing) Non-extractive use (e.g. welfare from diving tourism)	Values arising from flow-on effects of use values to the broader community *Examples:* Proxy: Business revenues, tax income, employment (e.g. tackle shops, dive operators, hotels)	Values for environmental conservation (existence and bequest/altruistic values) including for the use at a later date (option value) *Examples:* Knowledge that reef-based protection has increased marine biodiversity Knowledge that a unique habitat is conserved intact for future generations
Consumer surplus	**Market values**	**Consumer surplus**

Table 1: Values attributed to man-made marine structures

Use and Community Values: *Benefit Transfer*

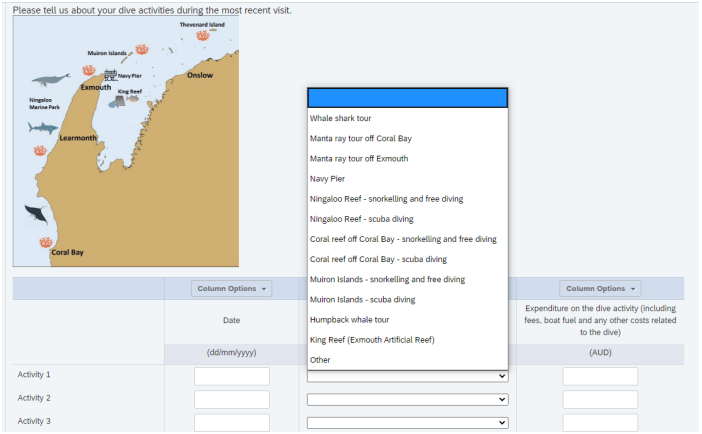
- Existing information and data (King Reef, Exmouth)
- Recreational fishers

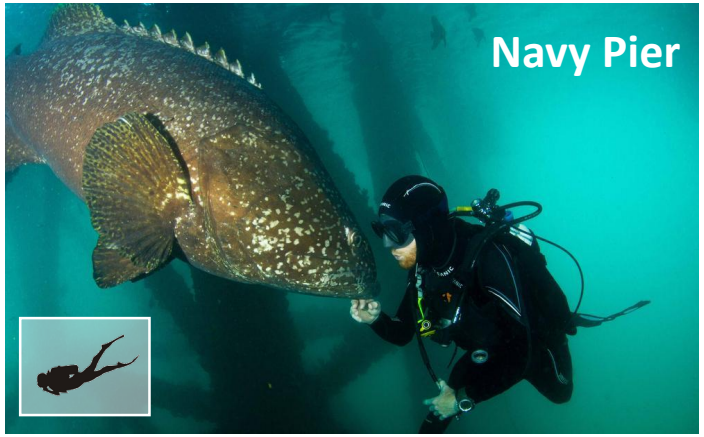
Ecology	Change in biomass
Quality of activity	Change in catch rate
User Behaviour	Change in level of use
Economic information	Consumer surplus, expenditures



Use and Community Values: Single Site

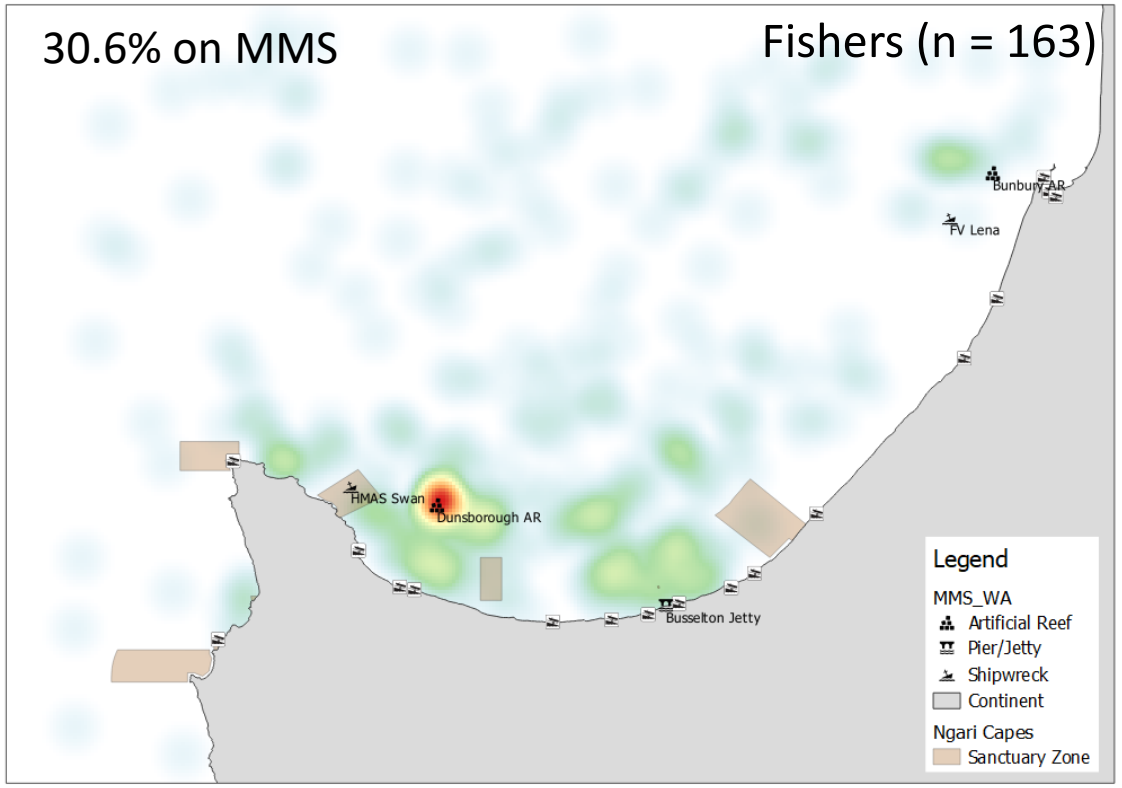
- Travel cost online survey (Navy Pier)
  - Divers
  - Travel costs
  - Frequency of trips in 2019/2020

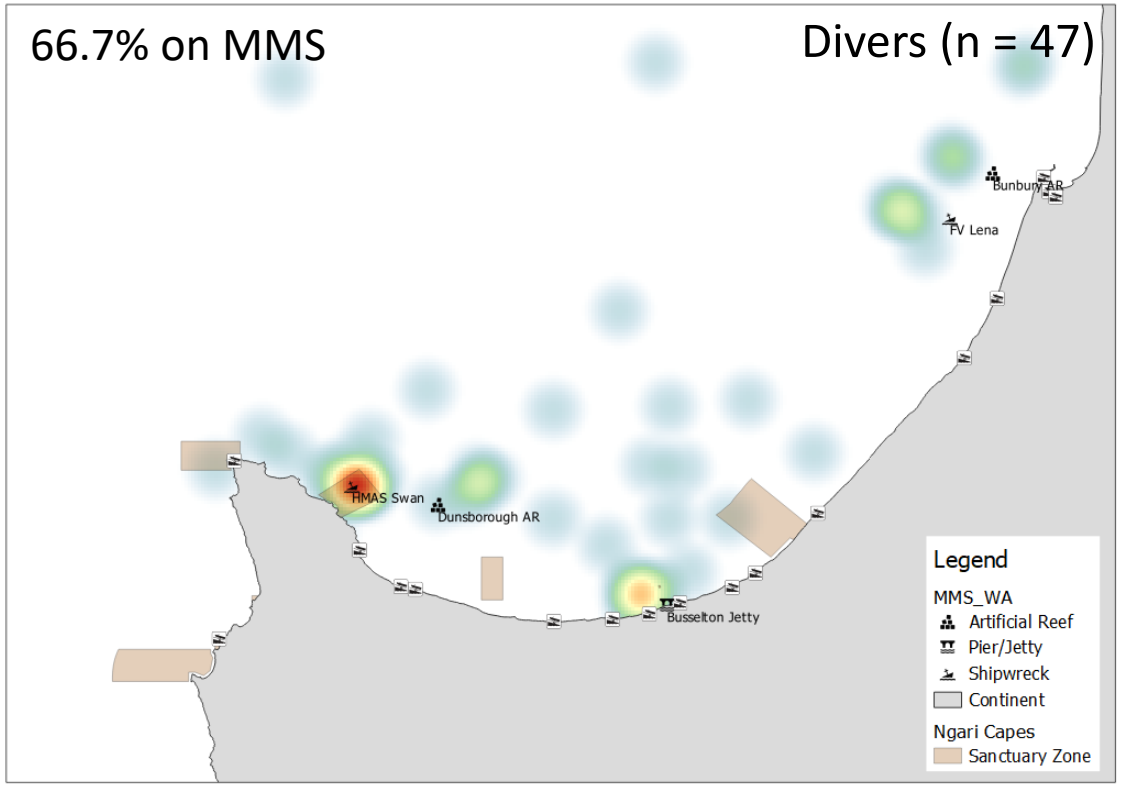




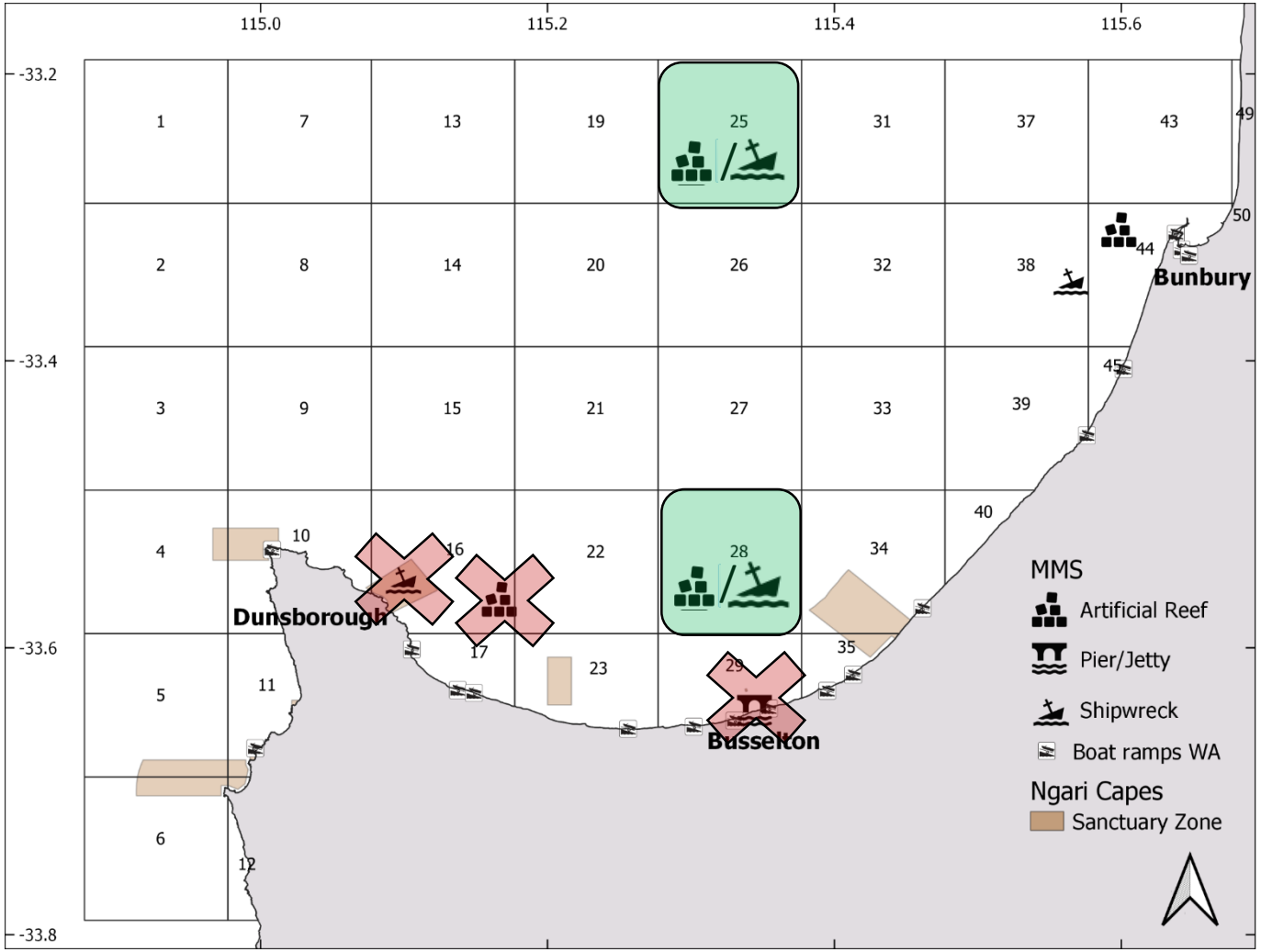
Use Values: Multiple Sites

- Random utility model
- Boat-based fishers and divers survey
- Geographe Bay, Coral Bay, Exmouth and Onslow region





Use Values: Multiple Sites



Non-use Values: WA

- Discrete Choice Experiment Survey (WA rigs-to-reefs)
- WA general public
- Social license to operate

Choice set with levels of attributes

	OPTION 1 **Rig-to-reef** 	**OPTION 2** **Rig-to-reef** 	**OPTION 3** **Complete removal**
Total fish biomass (tonnes)	0.5	1.5	Negligible
Fish attracted vs. Fish produced	Produced	Produced	N/A
Habitat for threatened species	Yes	No	
Who can access the reef	Recreational Fishers	Recreational Divers	
Future liability in case of any environmental damage occurring	Government (taxpayer)	Government (taxpayer)	
Amount of money (AU$) paid to the State budget by the Company	160 million	100 million	0

Non-use Values: WA

- Overall, high level of acceptability of rigs-to-reefs
- 9.4% of respondents opposed to rigs-to-reefs under any possible scenario
- Preferences higher towards reefs providing habitat threatened species, increased fish biomass, production of fishes, access for divers, and/or increased revenue for the State budget
- Preferences lower if liability lies with the Government, or social licence granted to the oil and gas sector was low

- High resources, higher accuracy

Take Home Messages

- We quantified economic values associated with a variety MMS for
  - Use values
  - Community values
  - Non-use (existence) values
- More complex techniques can simulate values for prospective structures and address reallocation of effort
- Values depend on the environmental improvements and the level of use
- Values are influenced by regulation of access and liability

SOCIAL VALUES – INDIVIDUALS

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Social values and perceptions – online survey

Objective

- To identify and explore the socio-economic values of manmade marine structures (MMS) in Western Australia

Methods

- Conduct literature review to ascertain current levels of knowledge
- Conduct in-depth online survey involving diverse stakeholder groups to identify and explore values and perceptions associated with MMS

Key findings – Literature Review

1) There is very little coverage of social values and perceptions of man-made marine structures in the academic and professional literature

Literature review: 33 papers identified which examined social values and/or perceptions
- 70% of these focused on artificial reefs or wind turbines
- recreational divers were the most common stakeholder group

However, clear evidence of diverse values and perceptions within and across stakeholder groups, even from this small sample

- Material values (eg catch from MMS)
- Subjective values (eg satisfaction with experience of using MMS)
- Relational values (eg social interactions from using MMS)
- Perceptions of 'artificial' nature of reefs
- Degree of access to MMS

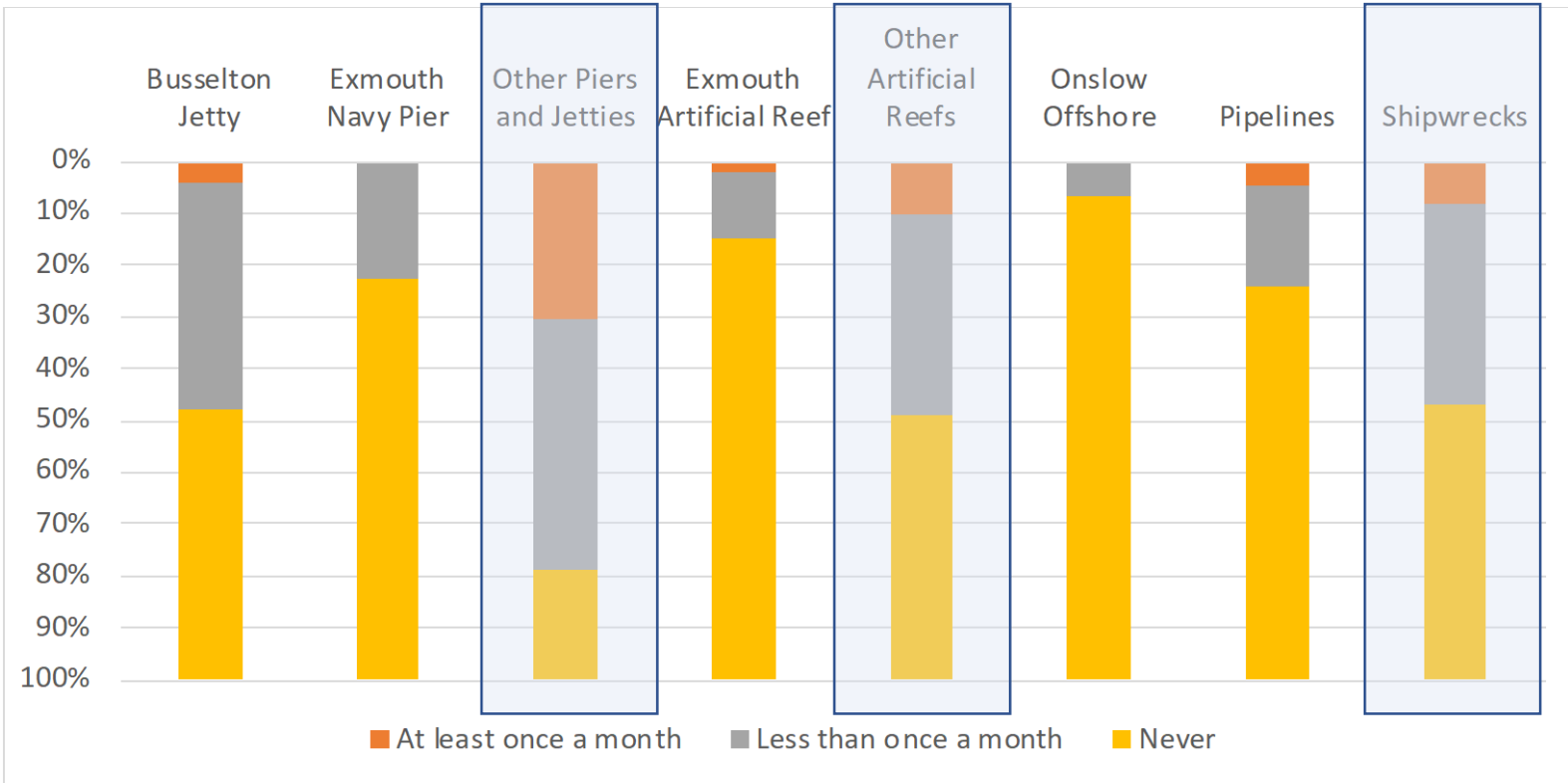
Key findings – Online Survey

2) Online survey succeeded in reaching a large number of stakeholders but an unequal distribution across stakeholder groups

	Frequency	Percent
Recreational fishers	353	64.2
Diver	90	16.4
Other	41	7.5
Commercial fishers	27	4.9
Not stated	39	7.1
Total	550	100.0

Key findings – Usage of MMS

3) Piers and jetties, artificial reefs and shipwrecks most frequently used MMS by survey respondents



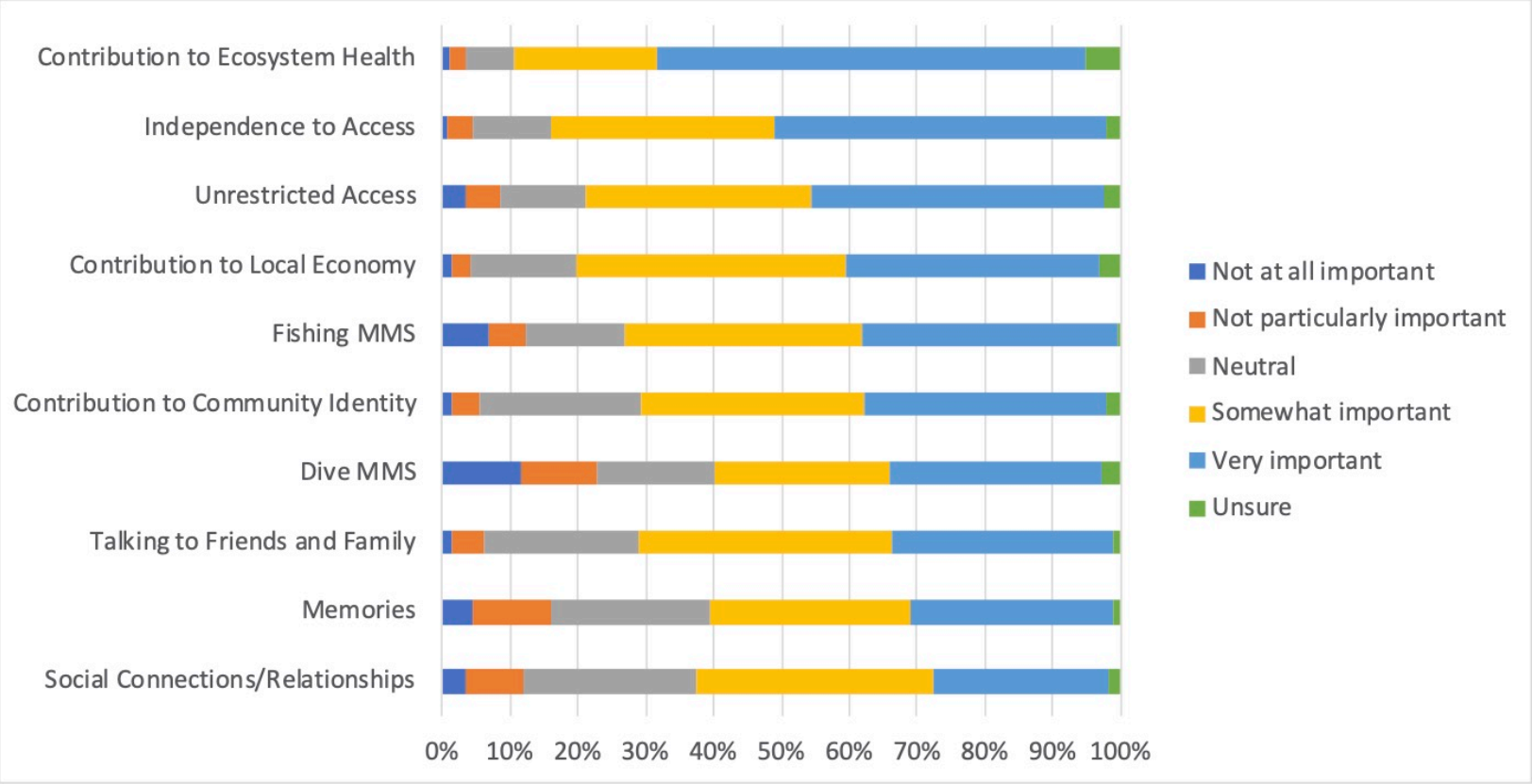
Usage reflects dominance of recreational fishers in sample

Case study MMS sites rarely used

Key findings – Social Values: all respondents

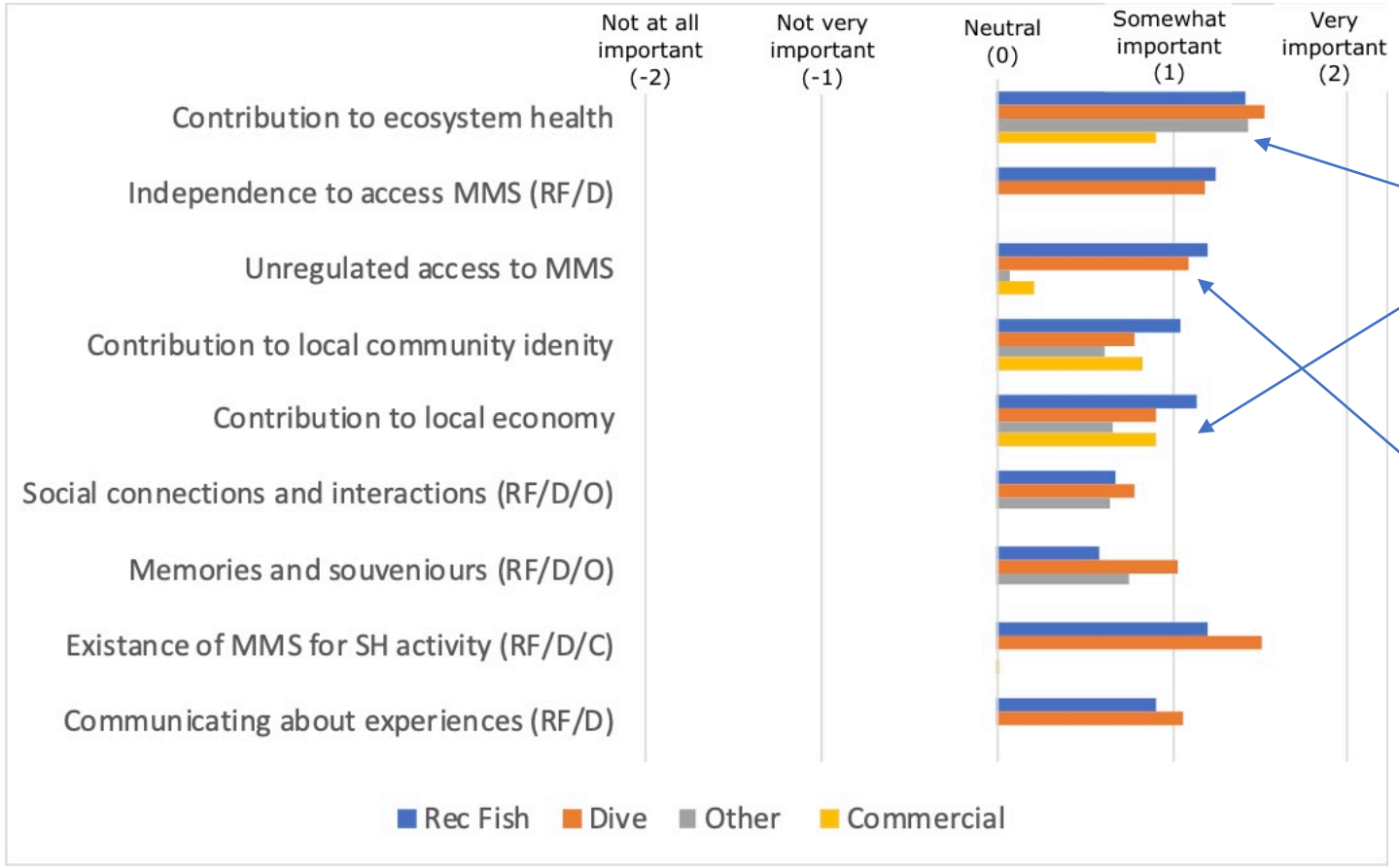
Social values reflect what is important to an individual. Values may be subjective (e.g. memories), relational (e.g. social interactions), and material (e.g. employment benefits).

4) Contributions to ecosystem health and access were most important values held by all stakeholders



Key findings – Social Values: stakeholder groups

5) Most values were rated similarly when disaggregated by stakeholder group



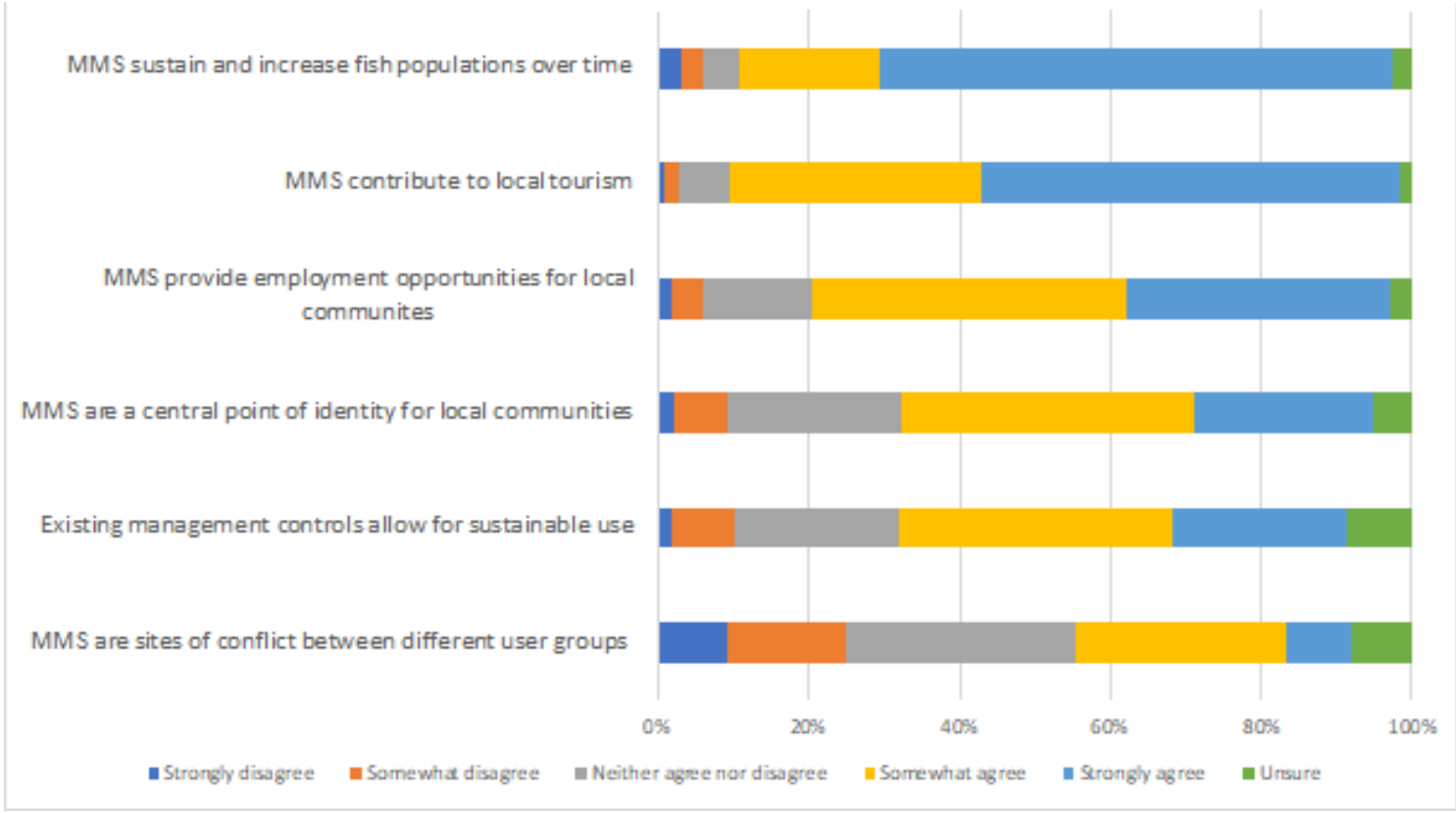
Environmental and economic values rated of similar importance across groups

Unregulated access was of more importance to direct users (fishers and divers)

Key findings – Social Perceptions

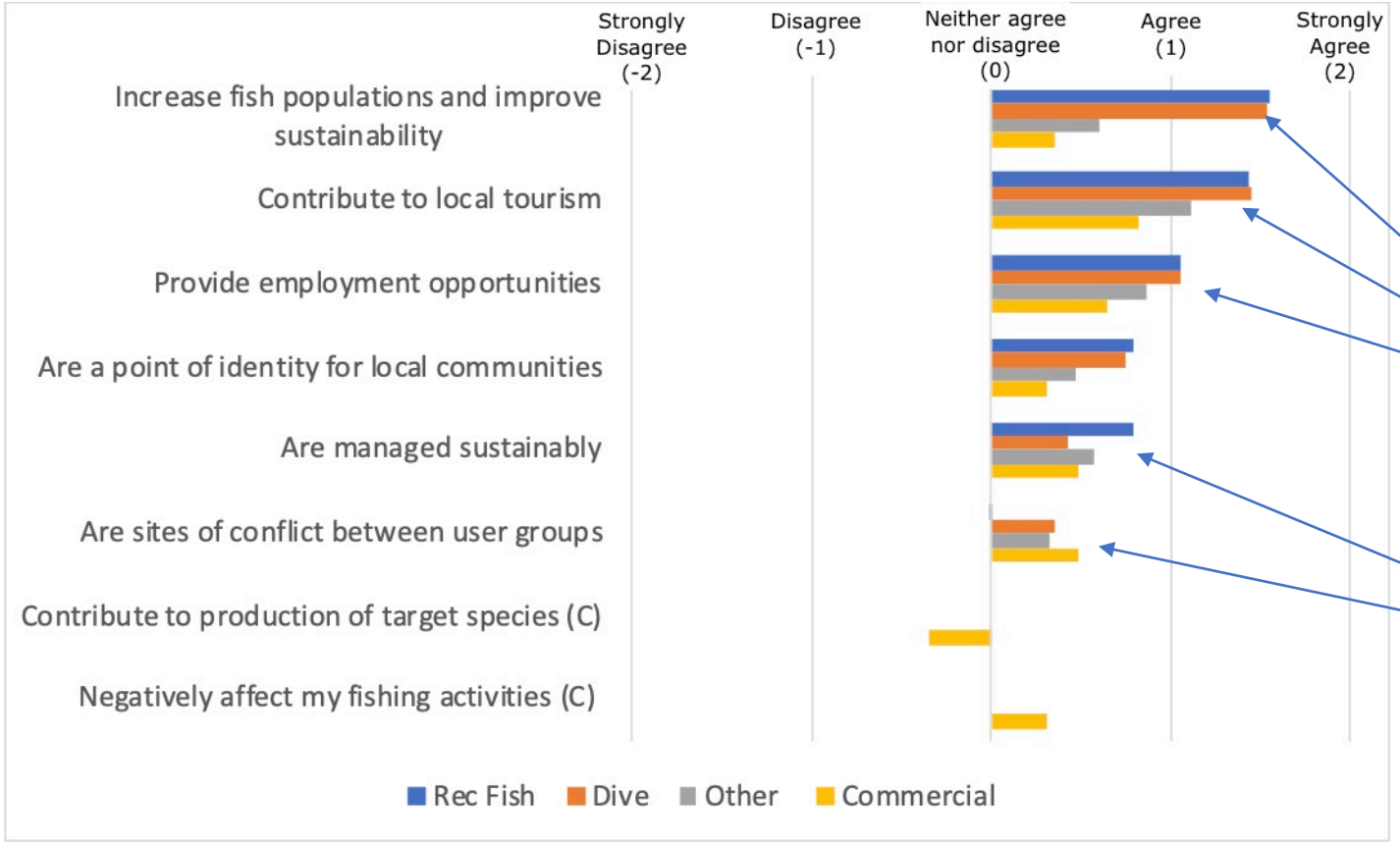
Perceptions reflect an individual's understanding of something. They can be positive or negative. Perceptions do not necessarily equate with value – an individual may perceive that MMS deliver positive benefits, but those benefits may not be of value to the individual.

6) Respondents perceived strong benefits to environment and economy associated with MMS



Key findings – Social Perceptions: stakeholder groups

7) Some differences evident in perceptions of MMS held by stakeholder groups



Recreational fishers generally held more positive perceptions than other stakeholder groups

Environmental and economic benefits received most positive agreement

More neutral responses from all groups with respect to management of MMS

Take home messages

Recognition of the potential economic and environmental benefits of man-made marine structures was apparent across all stakeholders, providing evidence of a strong foundation to build public support

Commercial fishers were less certain that MMS delivered benefits with respect to biodiversity and fish stocks than other stakeholder groups, highlighting an area for future awareness-building

Concern amongst recreational fishers and divers as to MMS usage and access was noted, implying a need for greater management and enforceable regulations

Whilst respondents noted more opportunities than issues associated with MMS, this was predicated on the basis that managers would be capable of addressing any future issues, underlining the need to empower managers and maintain capacity

SOCIAL VALUES – GROUP

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Social Value Group: Objectives

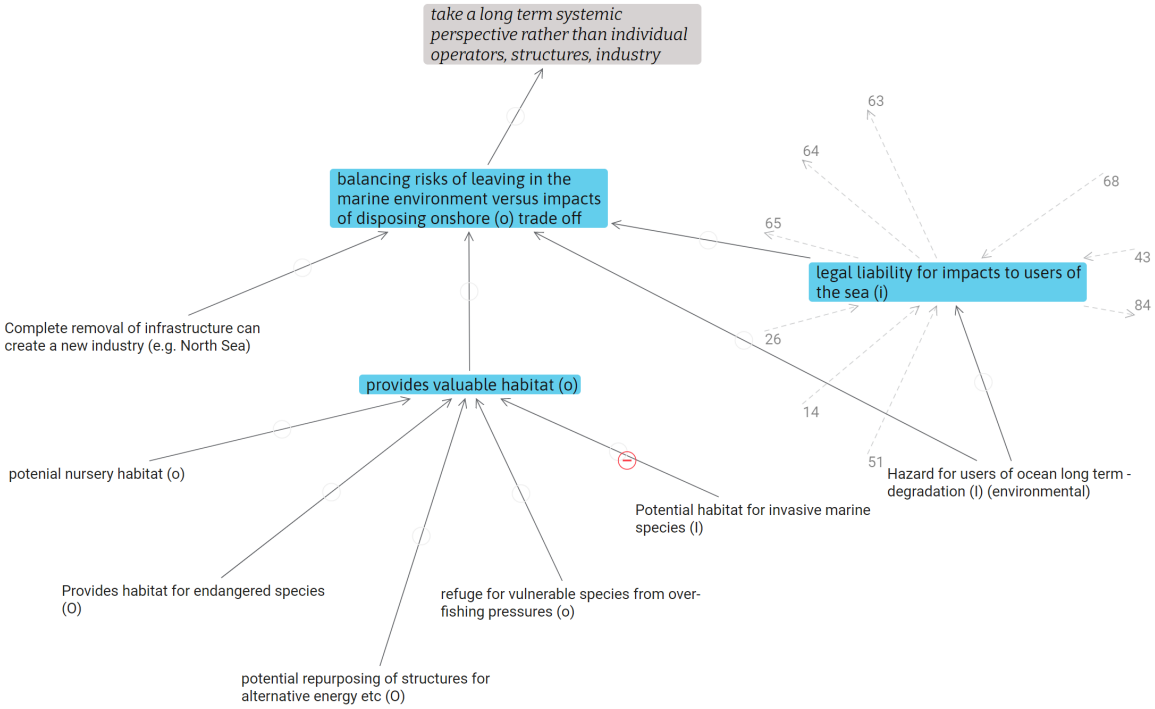
- Gain an **in-depth understanding** of stakeholder perceptions
  - through capture of *issues, opportunities and values* and their *impacts*
  - that reflects contexts (locations, cohorts)
  - and is contemporary
- Enable participants to **'listen' to one another** to
  - gain a wider understanding of the focus and
  - potentially change their mind
- Capture views from **different cohorts of stakeholders** to
  - Determine extent of homogeneity/heterogeneity
  - Understand the potential 'tensions' and collaborative possibilities

Workshop Attendees

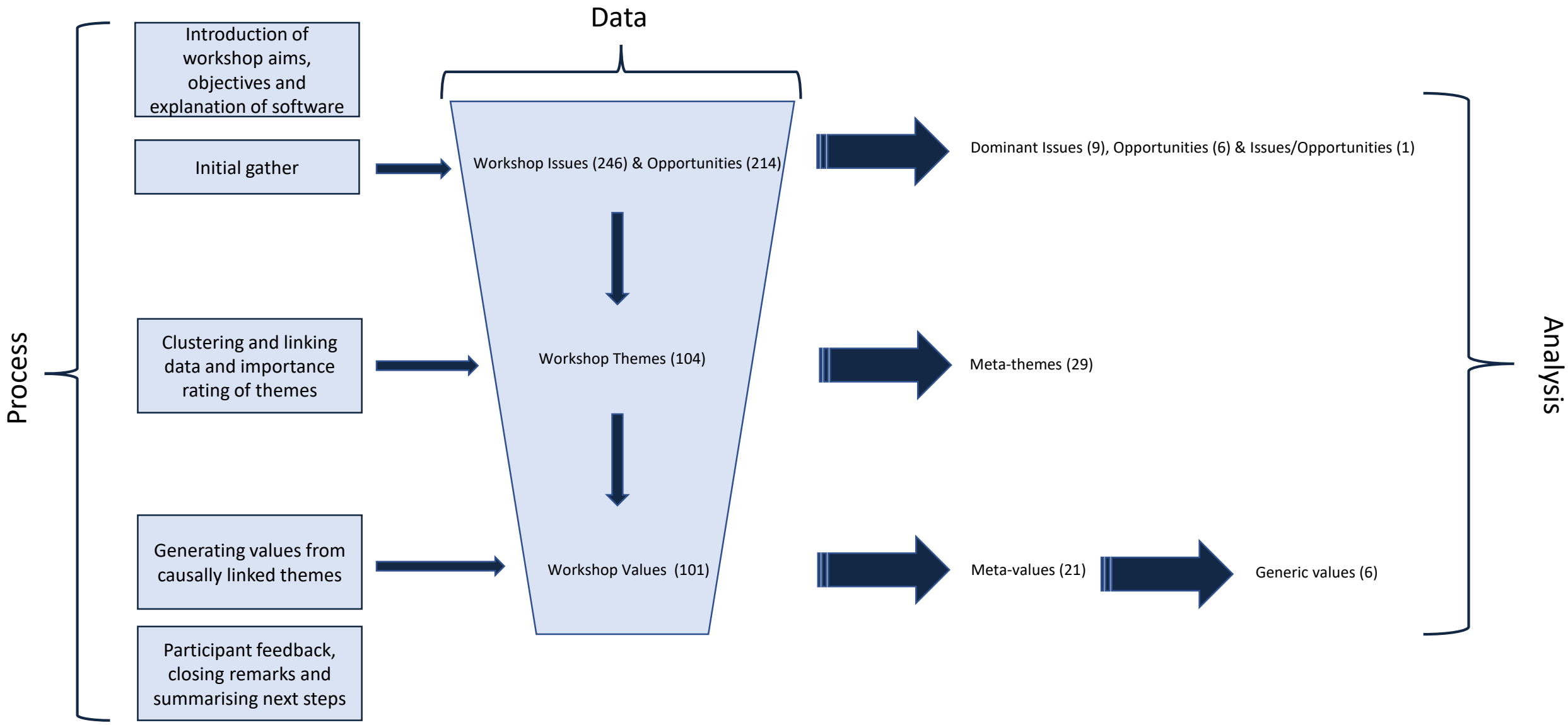
Workshop Stakeholder Grouping	Workshop(s)	Participants
Community	Exmouth 1	7
	Exmouth 2	8
	Karratha & Onslow	4
	Busselton	4
Oil & Gas	Chevron	4
	Oil & Gas	5
Regulator	Regulator 1	4
	Regulator 2	8*
Fishers	Recreational Fishers	6*
	Commercial Fishers	7*
NGO	Non-Government Organisation	7
Total:		***64***

*Participants joining from places other than WA (the Northern Territory, Victoria, Queensland, New South Wales and the Australia Capital Territory)

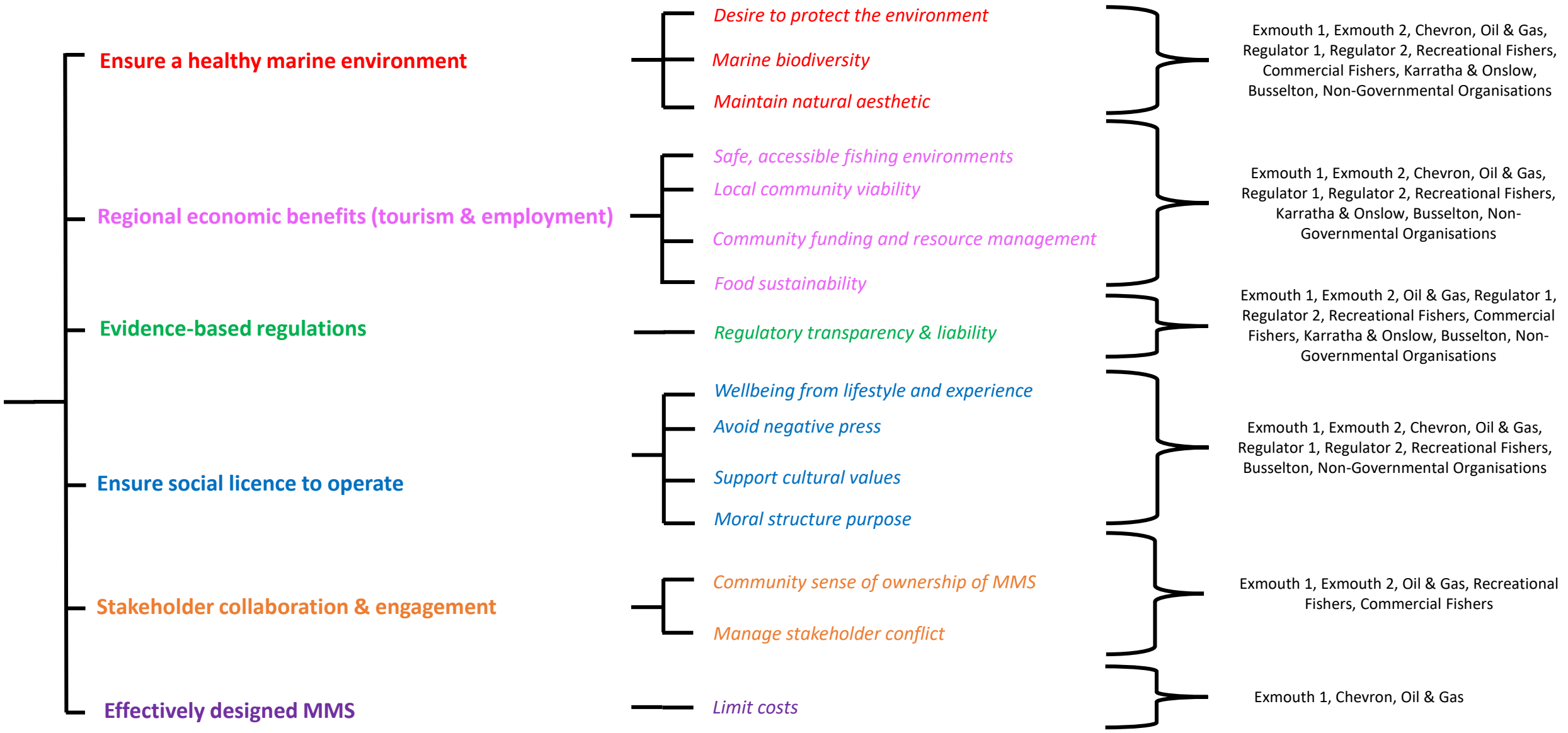
Exmouth Face-to-Face Workshop



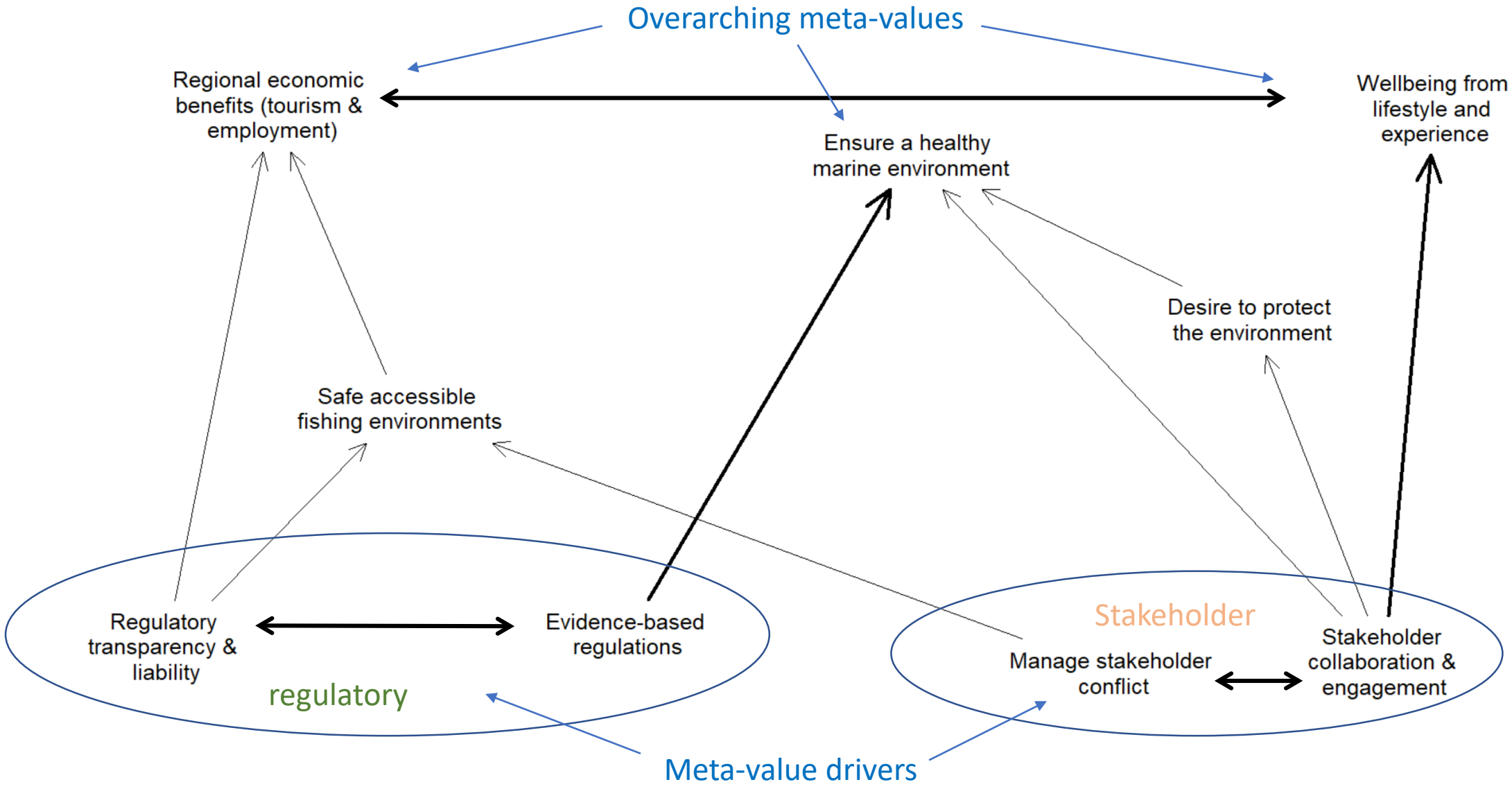
Workshop Process, Data and Analysis



Generic Values: Decision Tree



Meta-Values Map



Dominant Issues

Dominant Issue Grouping	Dominant Issues	Contributing Stakeholder Cohorts
Marine	Risk of fish stock depletion	**Community,** Oil & Gas, Regulator, Fishers, NGO
	Spread of invasive species	Community, Oil & Gas, Regulator, NGO
	Changes to natural aesthetic	**Community,** Oil & Gas, NGO
	Impact on natural environment	**Community,** Oil & Gas, **Regulator,** NGO
Liability	Lack of clarity around ownership/liability	Community, **Oil & Gas, Regulator,** Fishers, NGO
	Creation of user/navigational hazards	**Community,** Oil & Gas, **Regulator,** Fishers, NGO
	Disintegration of structure	**Community,** Oil & Gas, Regulator
Materials	Perception of 'dumping'	Community, **Oil & Gas, Regulator,** Fishers, NGO
Use	Balance access across stakeholders	**Community**, Oil & Gas, Fishers

Dominant Opportunities and Issues/Opportunities

Dominant Opportunities Groupings	Dominant Opportunities	Contributing Workshops
Marine	Increased fish habitat	**Community,** Oil & Gas, Fishers, NGO
Community Benefits	Job creation	**Community,** Oil & Gas, **Regulator,** Fishers
	Increase tourism	**Community, Oil & Gas,** Regulator, NGO
	Ensuring economic gains	**Community,** Oil & Gas, Fishers, NGO
Materials	Recycling material	**Community,** Oil & Gas, **Regulator**
Use	Provides recreational uses	**Community,** Oil & Gas, Regulator NGO

Dominant Combination (I&O)	Contributing Workshops
Undertaking (further) research	**Community, Regulator,** NGO

Take Home Messages

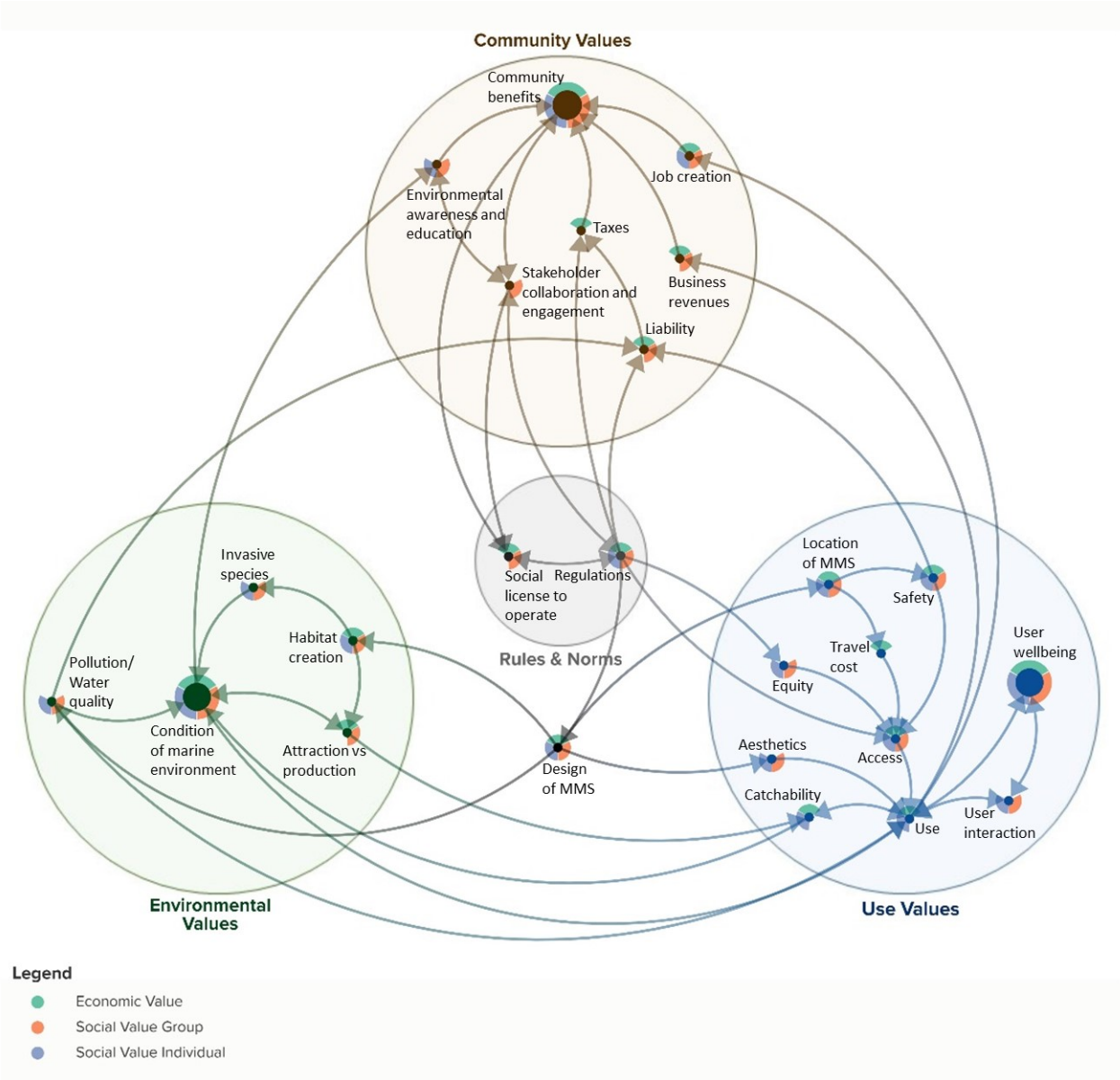
- A **diversity of interconnected values** substantiated by issues and opportunities with some degree of heterogeneity
- A need for evidence based, transparent, widely understood and universally adopted **regulations**
- The importance of each proposed structure being assessed against a **range of stakeholder benefits/interests** to determine optimal use.
- A significantly positive view of **benefits to the marine environment but**
  - different emphases between holistically rebuilding and protecting the environment
  - concerns such as pollution, invasive species, safety need to be managed
- Ensuring that any MMS provides **viable and sustainable community benefits**
  - build a **more comprehensive awareness** of the marine environment

Discussion: Integration of themes

- Disciplines identified similar use, community and environmental values
- Values interact in a systemic way
- Rules and norms influence all value fields

Objective 1

Augment and integrate analytical methods to identify and explore the socio-economic values of man-made marine structures in Western Australia.



Discussion

- Man-made marine structures have social and economic value!
  - Information needs to be incorporated into policy and decision making.
  - More important than ecological information?
- There are concerns and issues!
  - To gain support proponents need to address those issues and concerns and engage with all stakeholders meaningfully.
  - BUT, in general many stakeholders see opportunities
- MMS as sites of conflict!
  - Resource sharing and allocation of exclusive rights (eg HMAS Swan and Perth)

Discussion

- Many man-made marine structures now. Many more in the future! (Objective 2)
- Opportunities!
  - Can we optimise outcomes by incorporating values of users?
    - Eco-engineering
    - Stakeholder engagement and collaboration
    - Defining the purpose
    - Resource sharing and allocation
  - Changes to policy and legislation?
    - Needs clarity to facilitate social licence to operate and trust in the process
  - Habitat restoration and enhancement?
    - Oyster reefs (TNC)
    - Commercial fishing (Coral farming, Abalone)
    - Finfish Artificial Reefs (Trap/hook and line, eg China, Korea, India)
      - Are there ecological and economic benefits (production vs attraction)?
      - Socially acceptable?

Discussion

Many different approaches and methods for collecting and presenting socio-economic data

- Advantages and disadvantages and different resource and skills requirements
- Show cased different techniques throughout the study using the the case studies (Objective 3)
- “Cookbook” outlining different methods for collecting and analysing data for different questions (Objective 4)

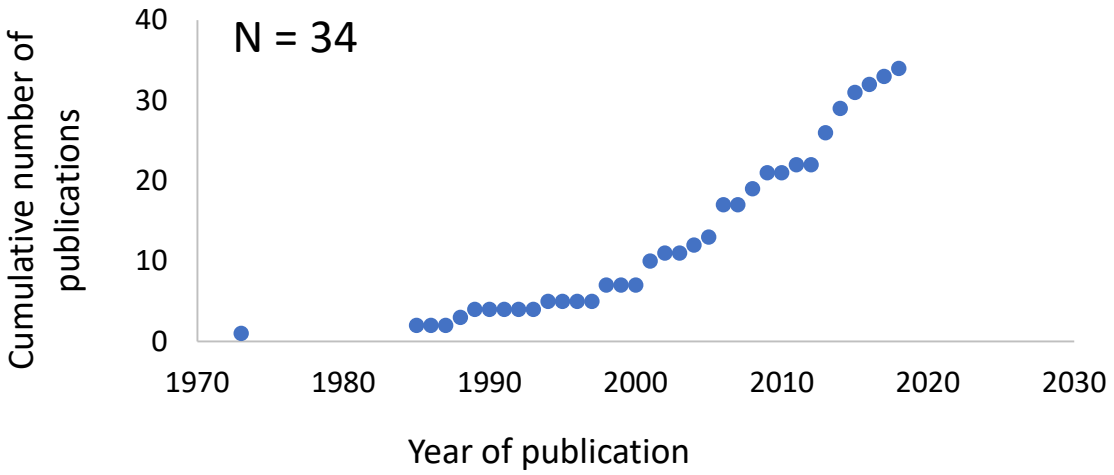
Gaps/Where to next?

- Indigenous values are not represented or captured at all.
- Peoples values will change over as they obtain more information
  - No temporal component or spatio-temporal
- Do people's attitudes and values change as more MMS are put in place?
  - Effects of accumulation of many structures
- Resource sharing and allocation. How?
  - the ability to quantify the relative values of a structure to different users may assist will allocation decisions
  - With comprehensive regional data on people's values and wants, combined with ecological data it is possible to develop a spatial allocation model to optimise the outcomes of deploying different types of MMS in different locations for different users

Questions

Appendices

Literature Review



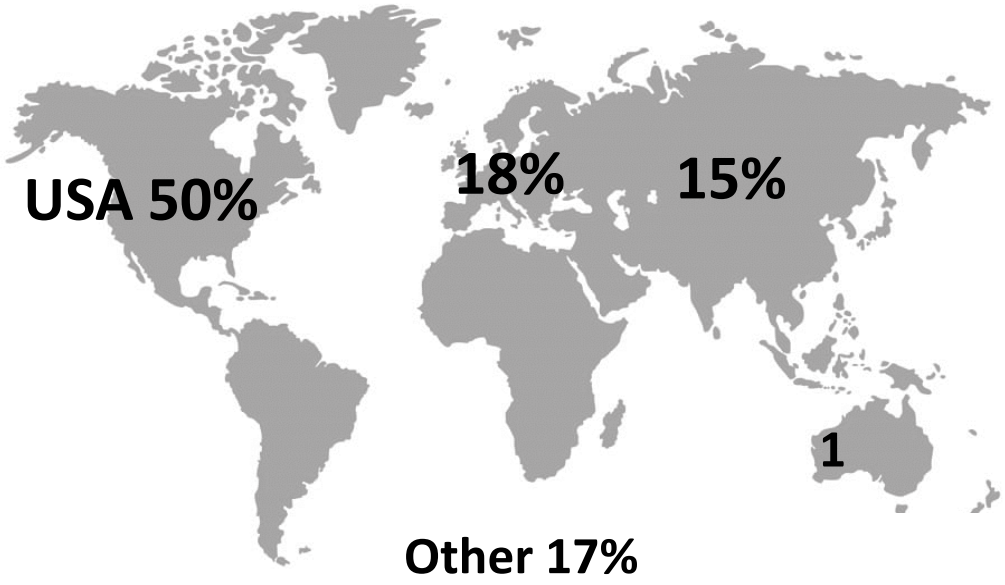


Table: Number of values estimated

	Com. fishing	Rec. fishing	Divers	Others
Use values	7	8	17	4
Indirect use	0	0	0	0
Non-use values	0	0	0	2

* exceed papers, due to multiple values per paper

Use and Community Values – Single Site

- Individual travel cost survey (Busselton Jetty)
- Recreational fishers, divers, other users
- N=195

Value Type	AUD/trip	Million AUD/year
Business Revenues	12	6.4
Consumer Surplus	36	19.3

Demand Model

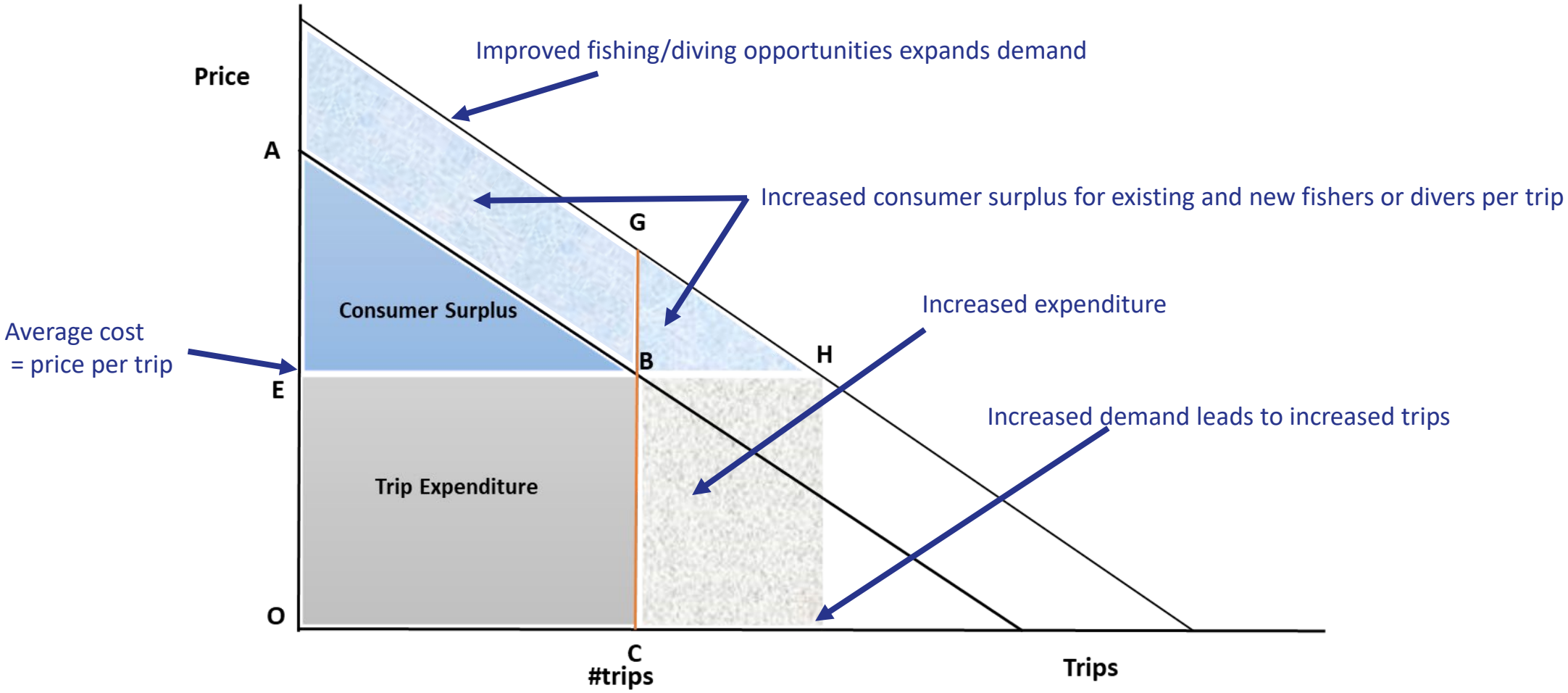
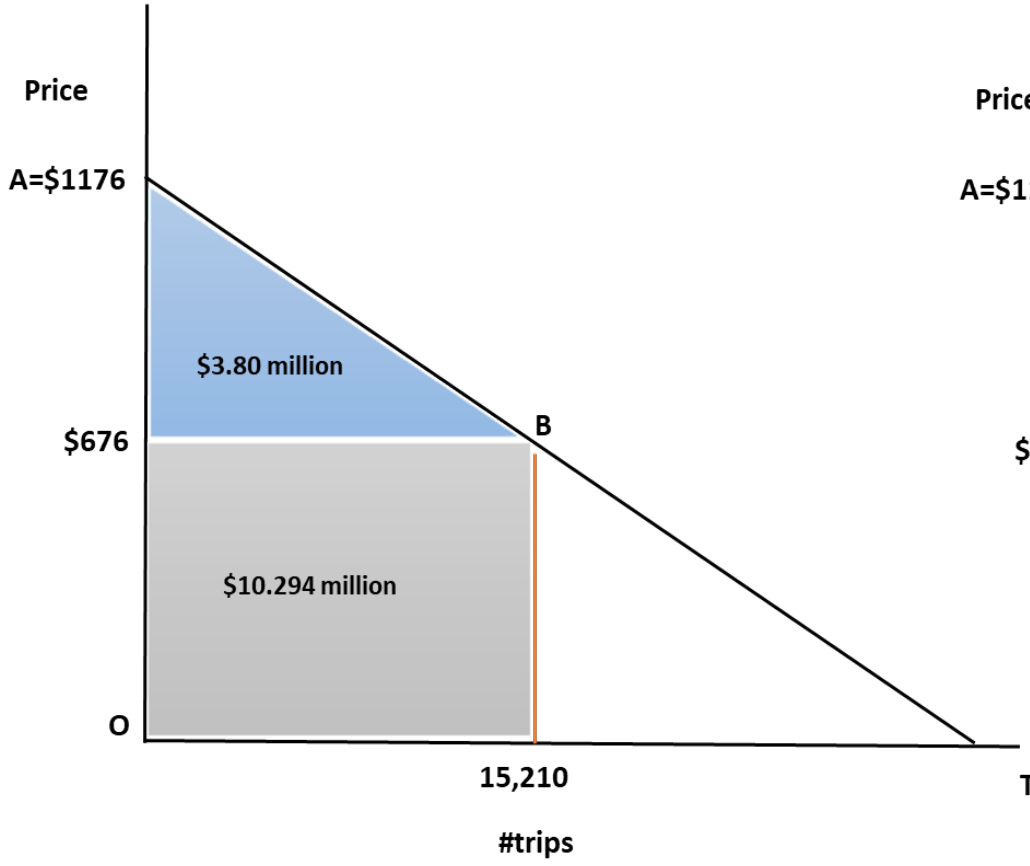


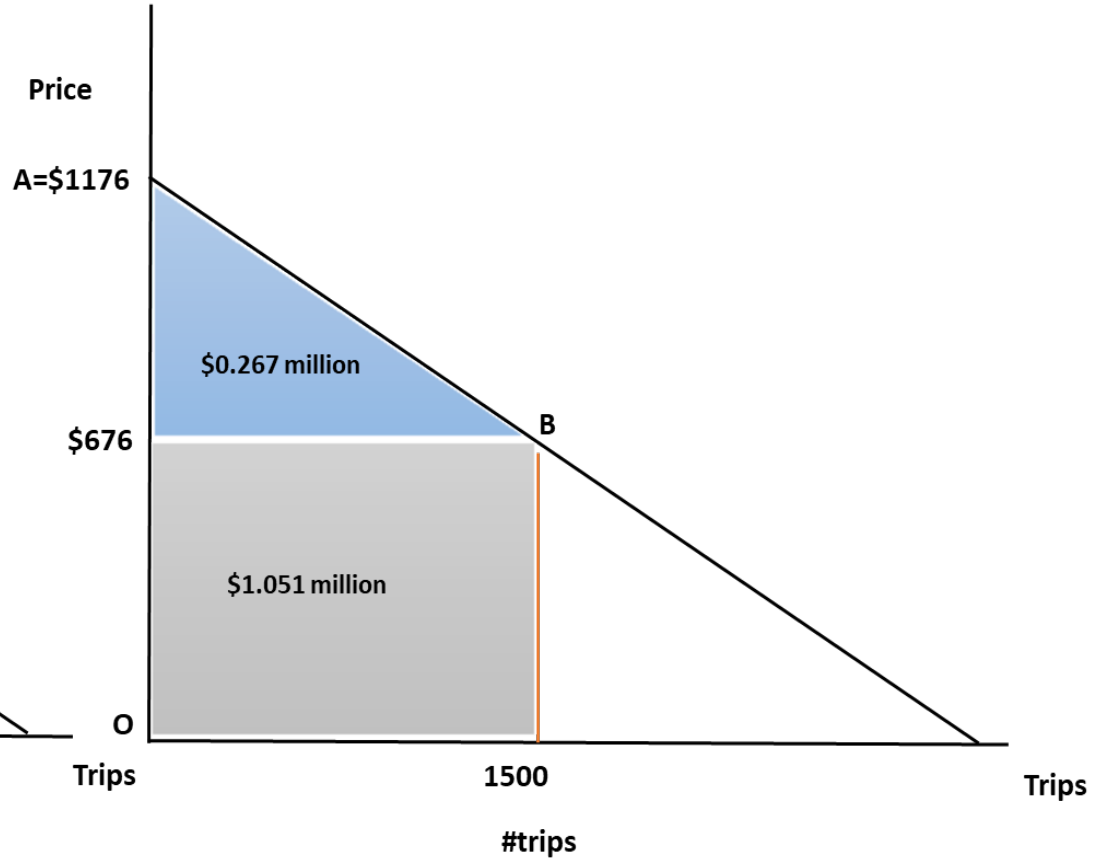
Figure: Expenditure and Consumer Surplus for Recreational Fishing or Diving following an improvement in fish abundance

Value of Artificial Reef When New Site Attracts New Fishers

- Base Fishing – Existing Sites

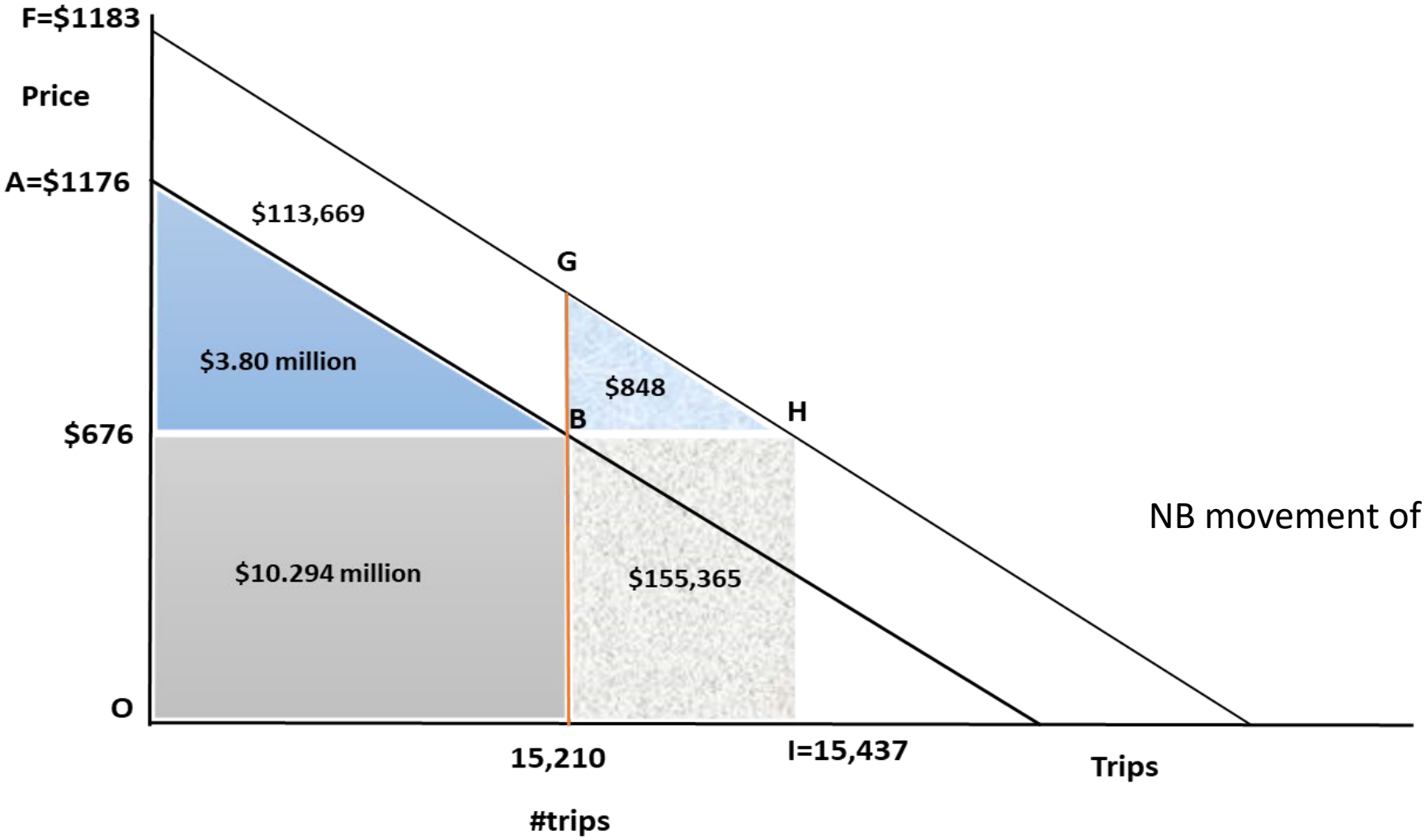


- Additional Activity on New Site



Assumes a 10 % increase in fishing trips, all attributable to the new reef

Increase in Value Due to an Improvement in Overall Fishing Quality



NB movement of lines not to scale

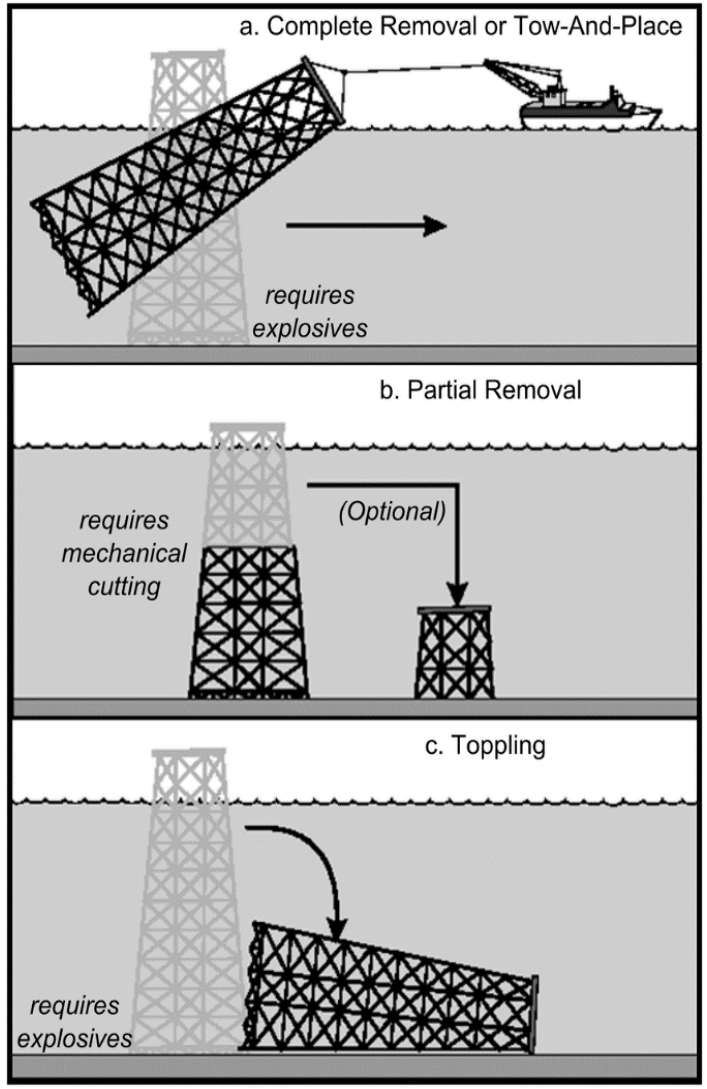
Assumes an average of a $7.5 increase in value per trip, across all fishers

Oil and Gas Infrastructure

Decommissioning options

- Status quo
  - Complete removal
- Alternatives
  - Leave in
  - Partial removal
  - Toppling

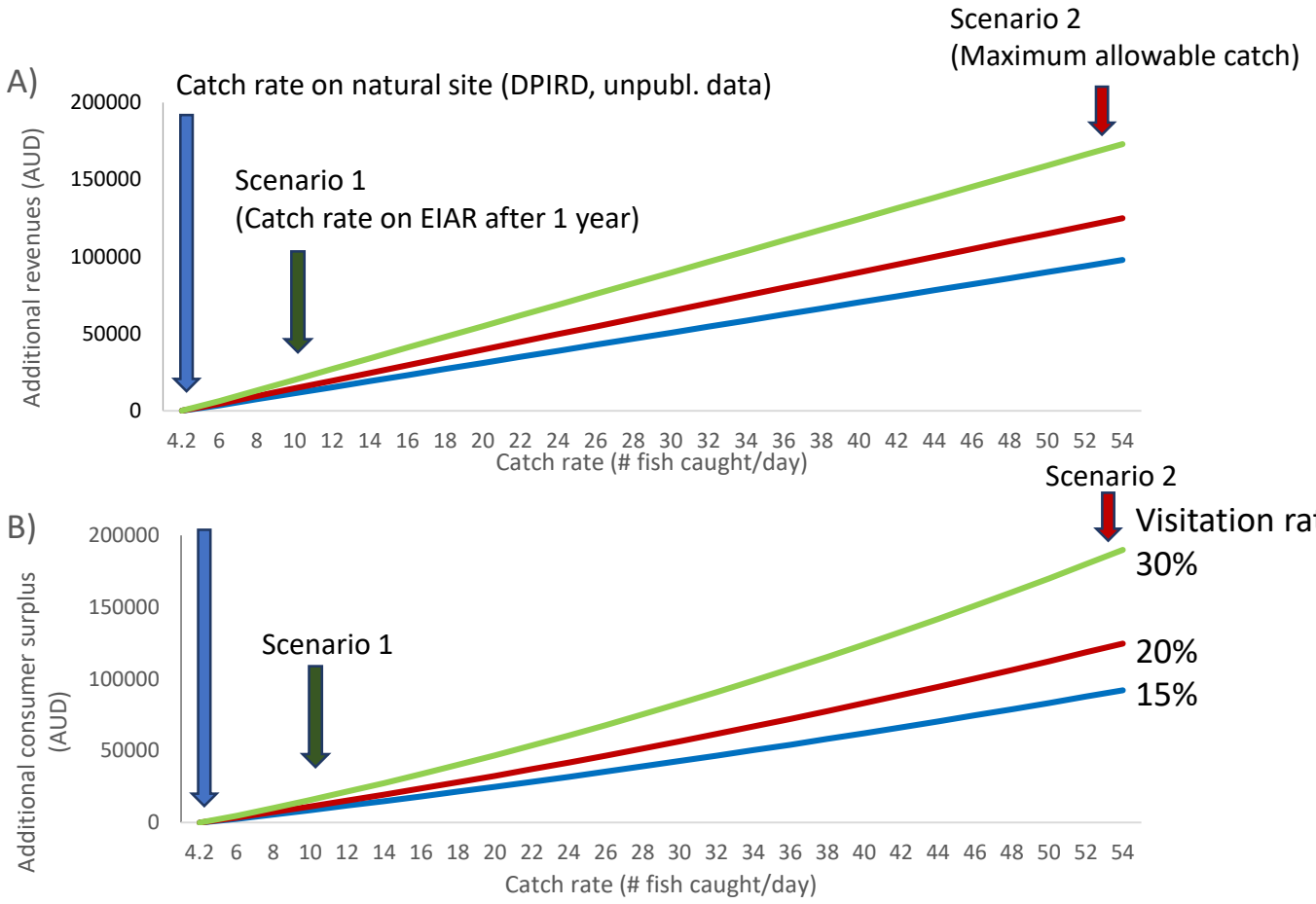
- > 100 oil and gas structures in the next 25 years in Australia



Use and Community Values - Benefit Transfer

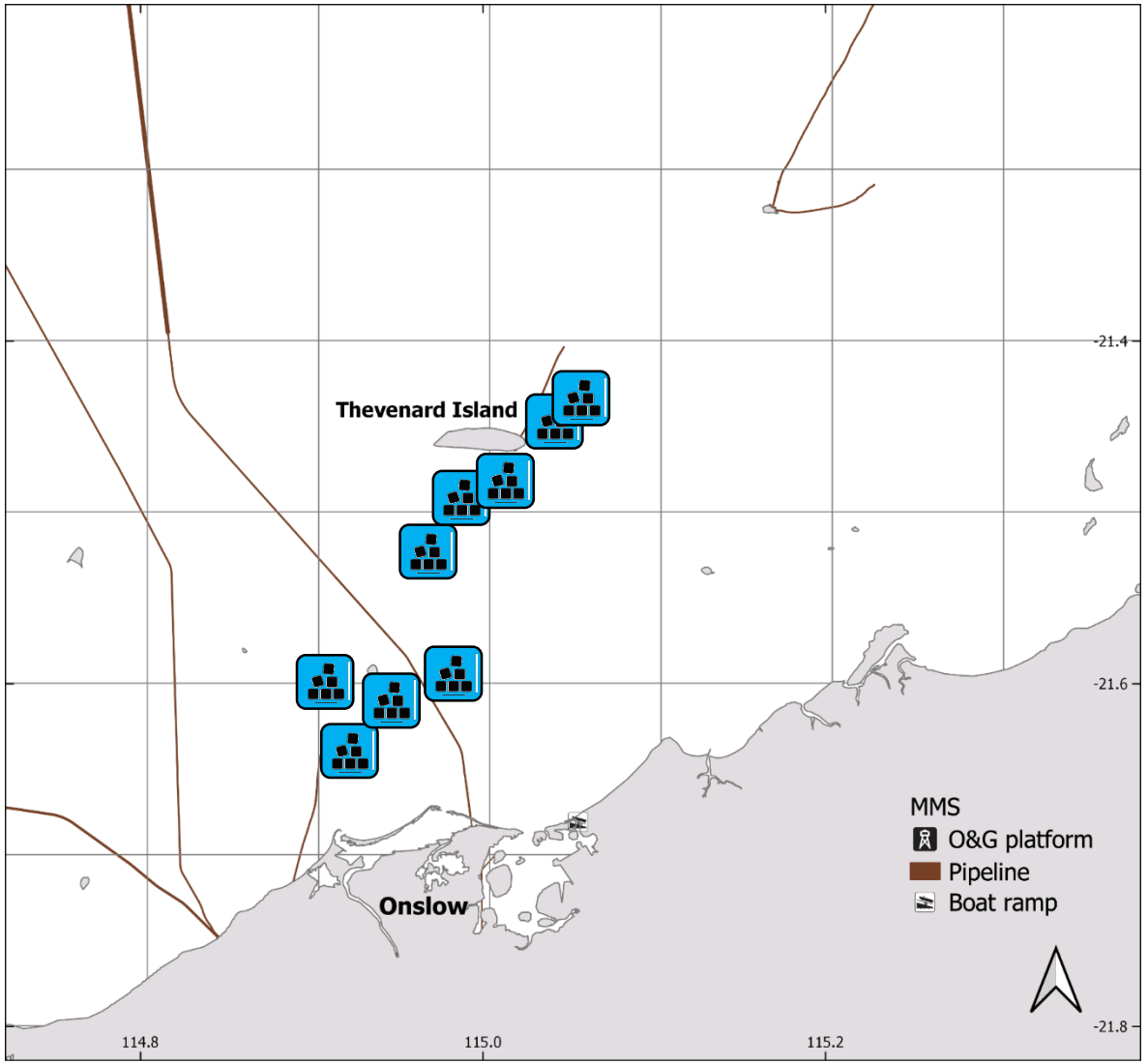
Thevenard O&G structures

- Scenario 1: Re-purpose structures into new AR
  - Assumed similar growth as the EIAR
  - Max. $23,242 revenues and $18,330 CS
- Scenario 2: Leave in place
  - Biomass of 250 to 365 higher on platforms than on natural sites
  - Max. $173,013 revenues and $189,872 CS



Use Values – Multiple Sites

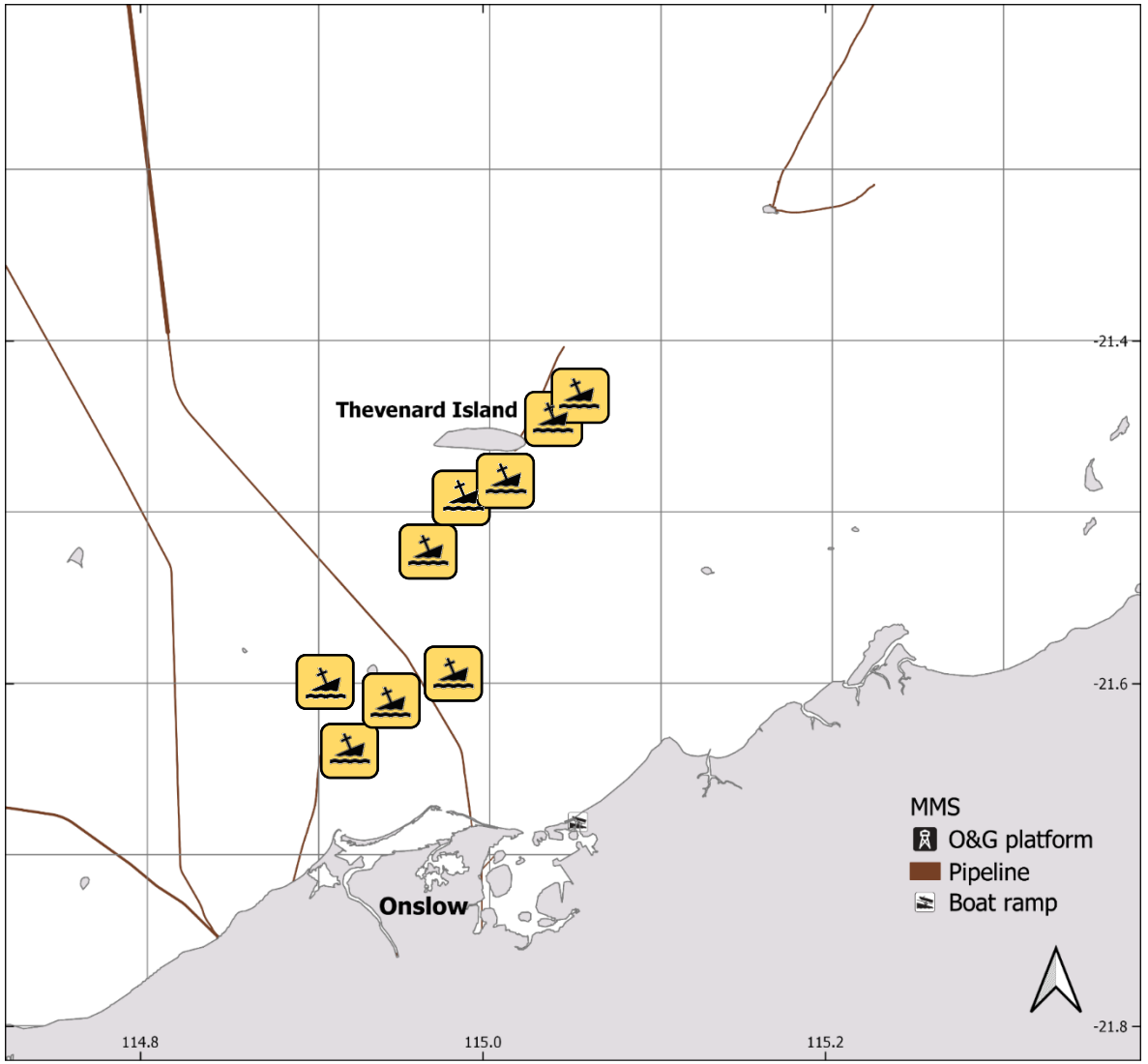
Onslow region



Use Values – Multiple Sites

Onslow region

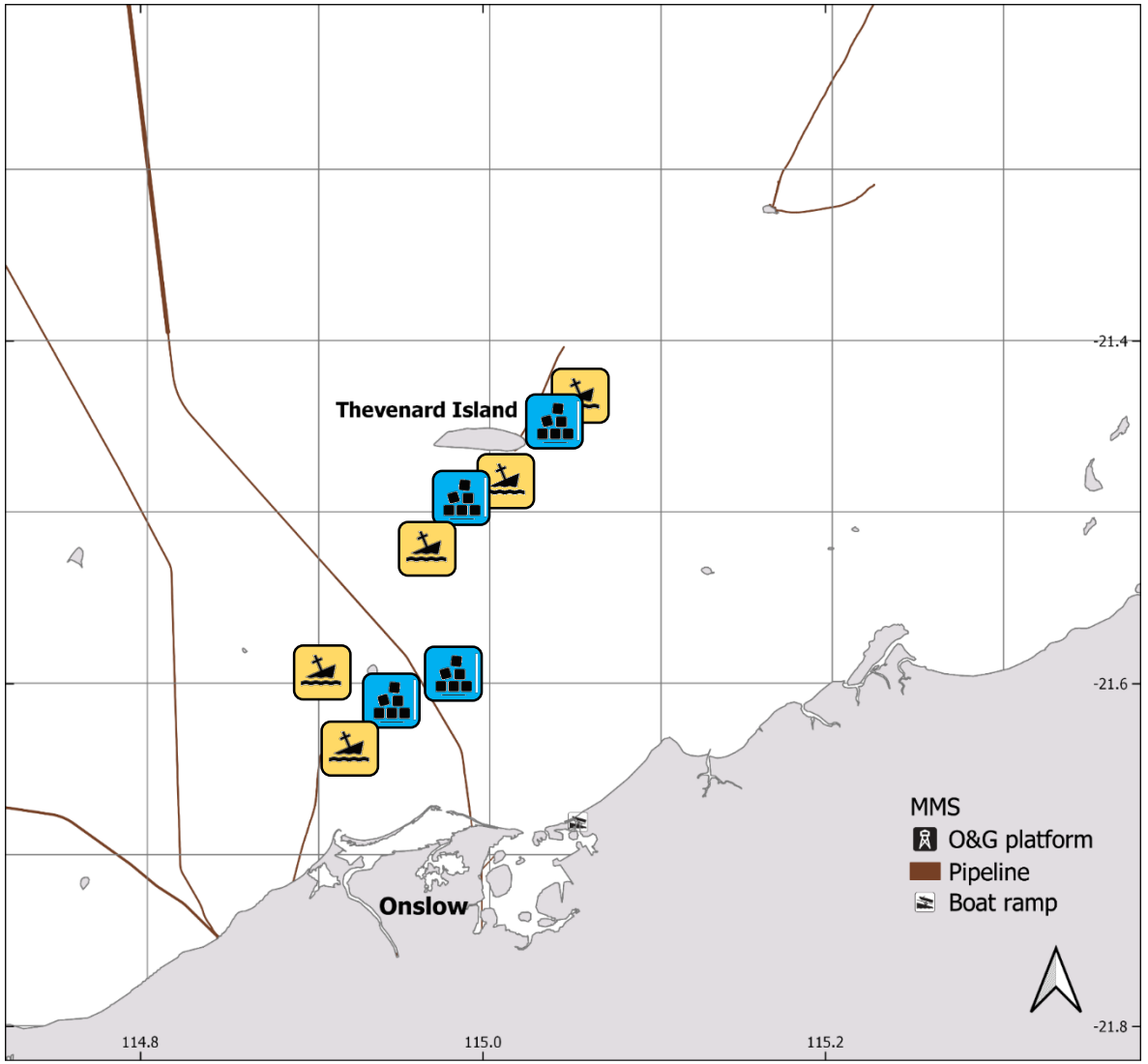
Scenario: Access to O&G structures	Rec. fishers	Divers
9 “artificial reefs”	1.19	0.10
9 “wrecks”	0.21	1.06



Use Values – Multiple Sites

Onslow region

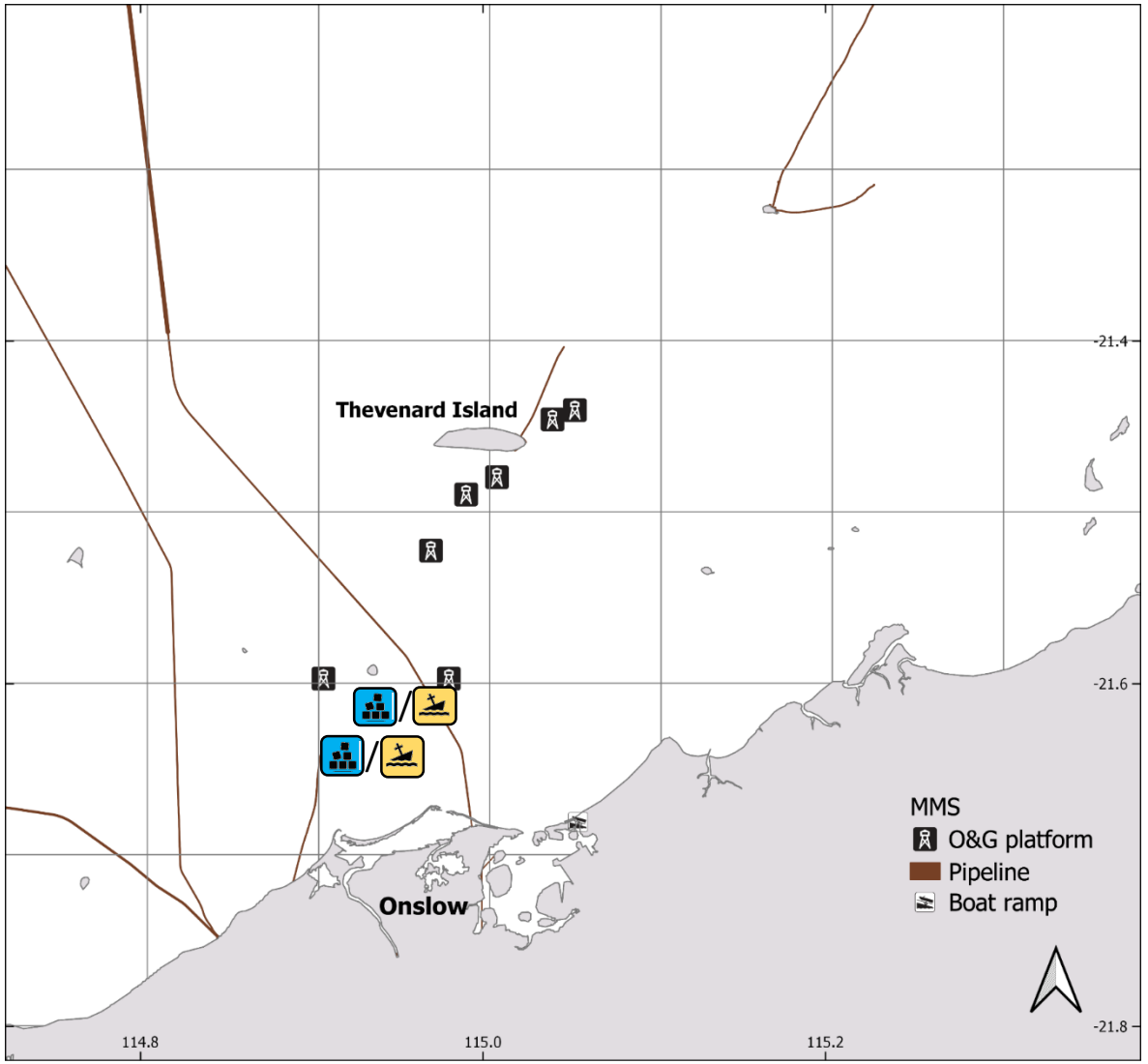
Scenario: Access to O&G structures	Rec. fishers	Divers
9 “artificial reefs”	1.19	0.10
9 “wrecks”	0.21	1.06
4 “artificial reefs” and 5 “wrecks”	0.50	0.60



Use Values – Multiple Sites

Onslow region

Scenario: Access to O&G structures	Rec. fishers	Divers
9 “artificial reefs”	1.19	0.10
9 “wrecks”	0.21	1.06
4 “artificial reefs” and 5 “wrecks”	0.50	0.60
2 “artificial reefs”	0.53	0.05
2 “wrecks”	0.09	0.54



Community values – Commercial fishing

- Echo Yodel pipeline
  - Ecological survey identifies a catch value of fish 8.5 times higher on pipeline than off
  - Evidence that trap fishers target pipeline

- Economic value is the estimated loss in *profits* if removed
  - Desktop modelling suggests this may equal ~AUD 55.000/year
  - Conforms with information that the benefit is relatively small (*pers. comm.*)