Adaptation of fisheries management to climate change

Management assessment tools & Manager perceptions

IATTC - 2nd Climate Change Workshop

Australia's National Science Agency

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Institute for Marine and Antarctic Studies

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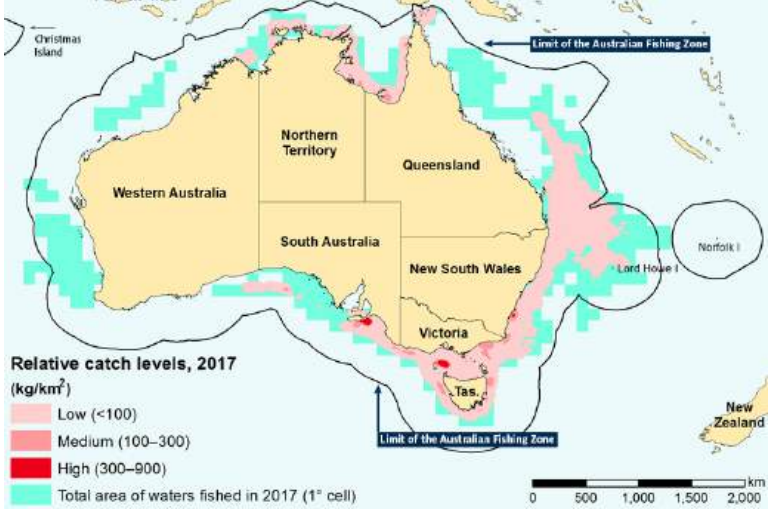
Context and Resources

- Series of projects to develop and apply tool for structured assessment of climate change vulnerability and risk – asking, *to what extent can available fisheries management responses reduce risk?*
- Designed to meet knowledge needs of fisheries management agencies and co-management committees
- Applied across multiple fisheries at both Federal and State-management levels



Guidance on Adaptation of Commonwealth Fisheries management to climate change | FRDC (project 1)

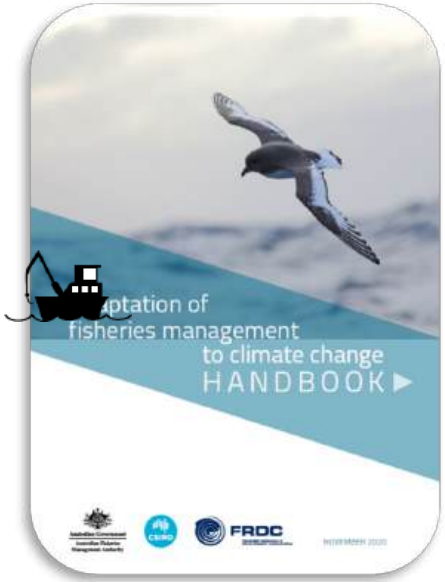
Applying the fisheries climate adaptation handbook to Australia's state fisheries | FRDC (project 2)

Sea Change: co-developing pathways to mitigate and adapt to a changing climate for fisheries and aquaculture in Australia | FRDC (linked project)

The tool – climate risk assessment for management

- Generate shared knowledge about climate risks
- Identify robust adaptive management options
- Encourage medium and long term (and out of the box) thinking & preparedness

Handbook



Online tool

https://fishadapt.csiro.au/

User Guide for Handbook App

https://research.csiro.au/cor/research-domains/climate-impacts-adaptation/climate-adaptation-handbook/

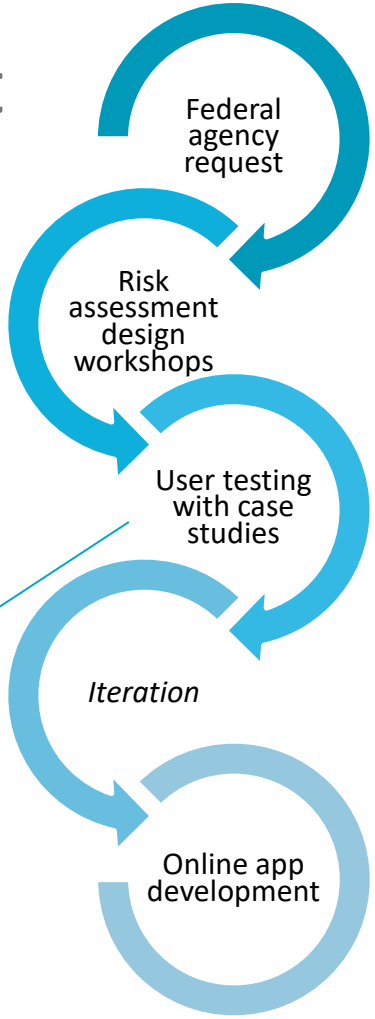
Tool –
Climate risk assessment framework for fisheries management (project 1)

Tool development (project 1)

Northern Prawn Fishery

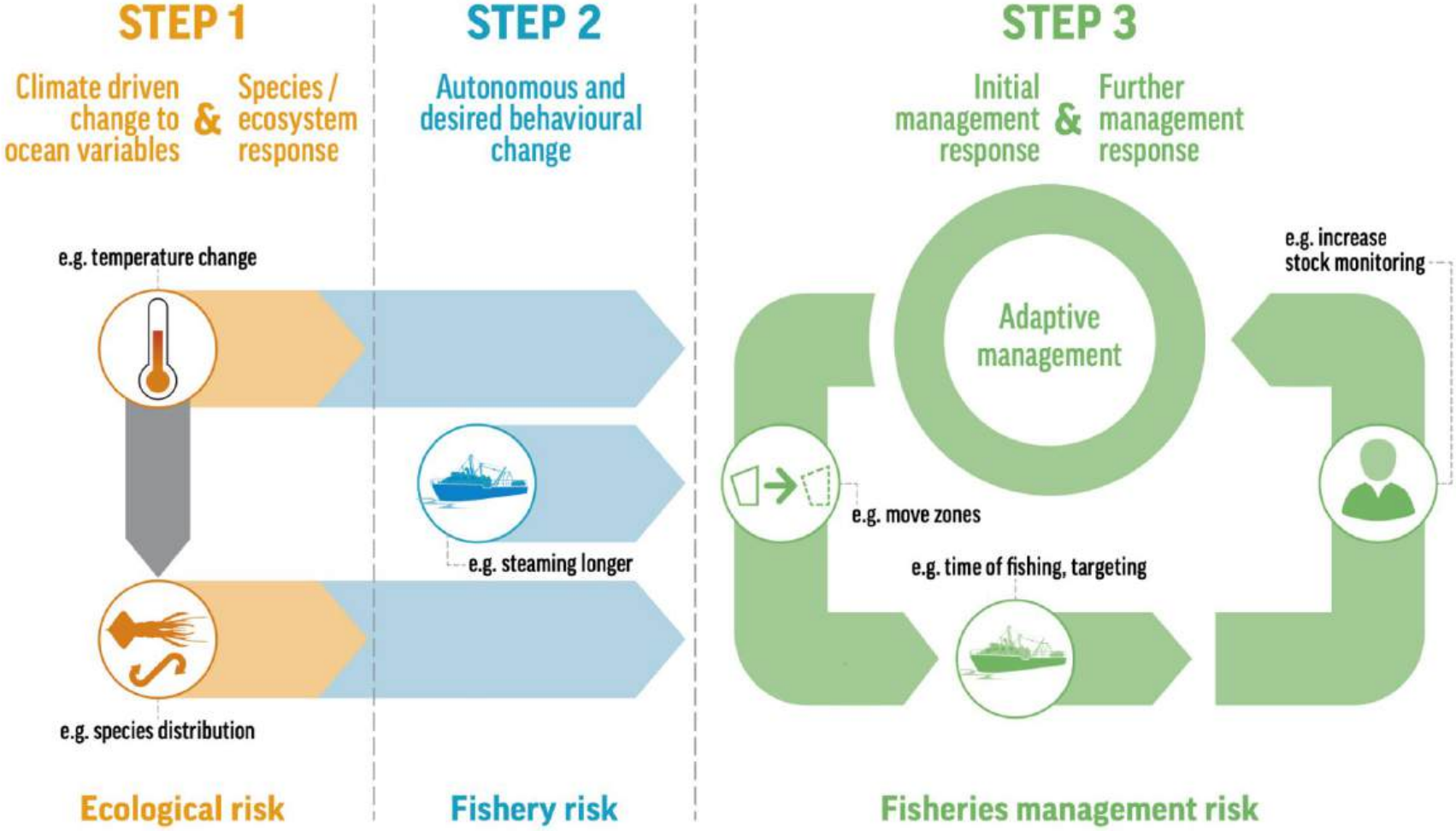
Southern Bluefin Tuna Fishery

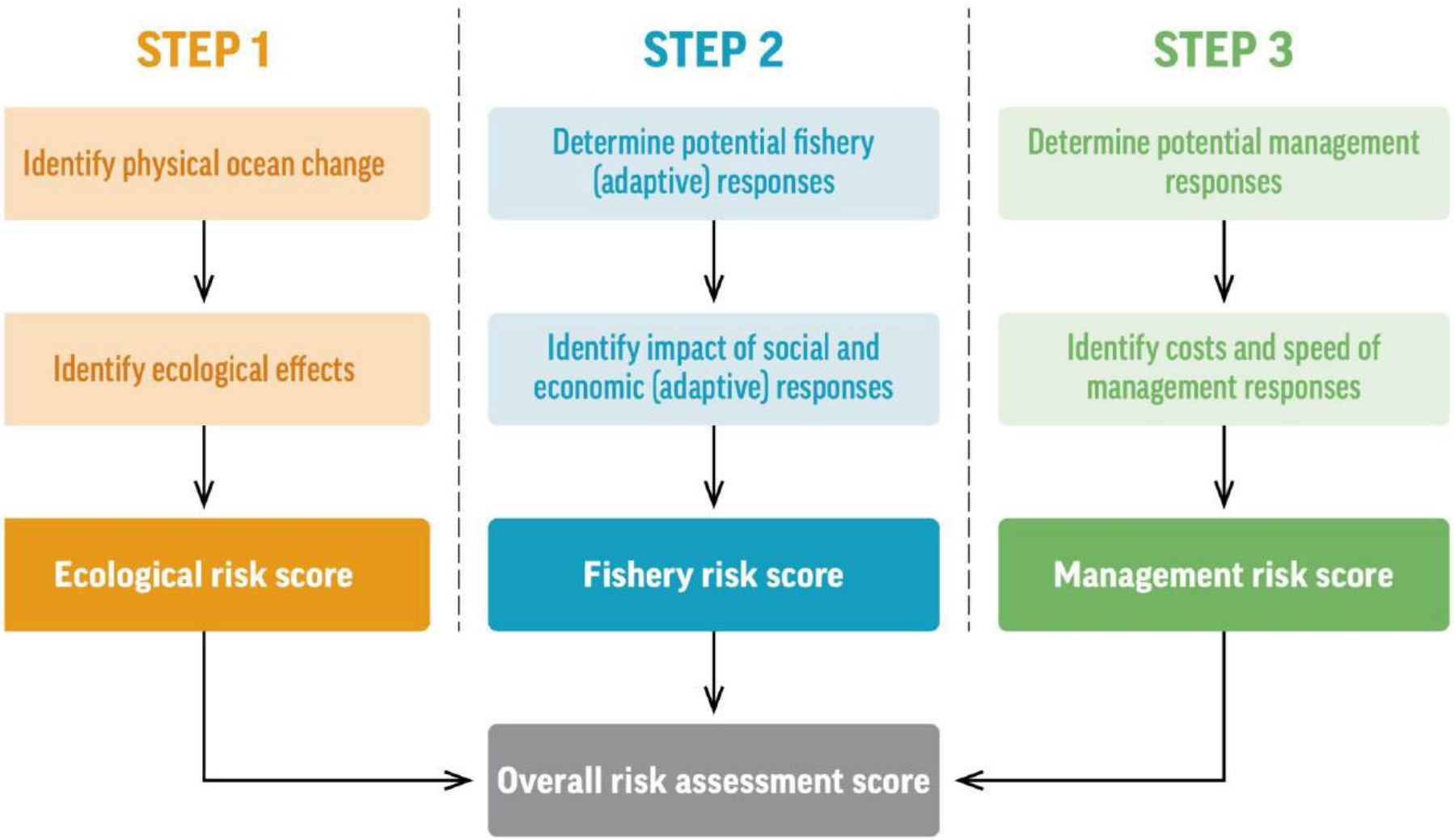
Heard Island & MacDonald Islands Fishery



Objectives:

1. To assess how well the existing Commonwealth fisheries management framework will cope with climate change impacts
2. To develop a methodology and approach for fisheries to adapt their regulatory environment to climate change impacts on fisheries
3. To develop strategies and priorities to account for effects of climate change in the management of fisheries

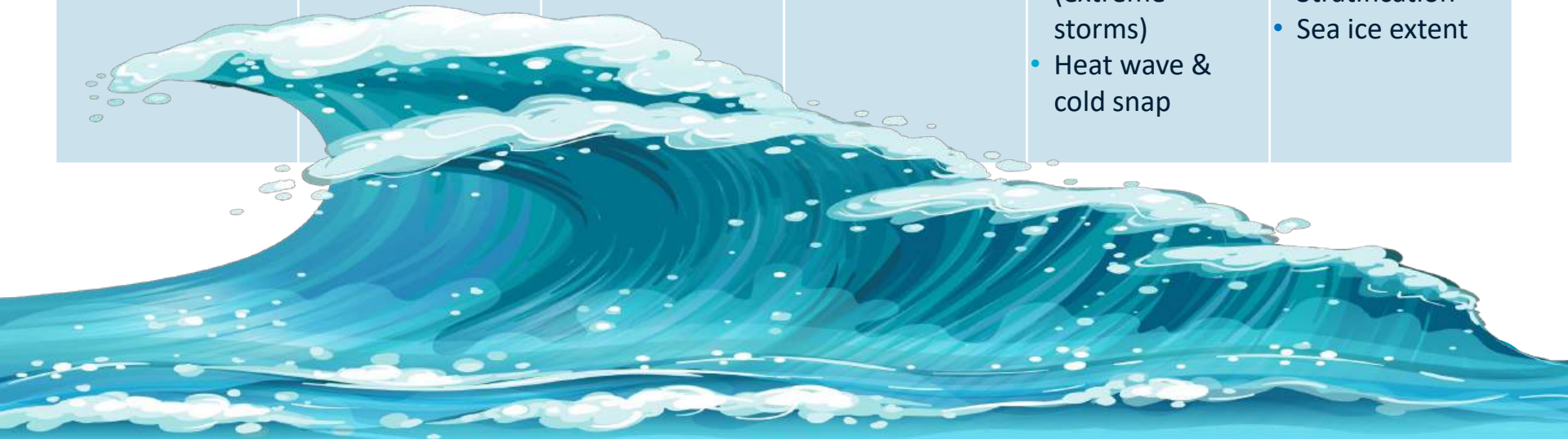

STEP 1
Climate driven change to ocean variables
&
Species / ecosystem response
STEP 2
Autonomous and desired behavioural change
STEP 3
Initial management response
&
Further management response
e.g. temperature change
e.g. species distribution
e.g. steaming longer
Adaptive management
e.g. increase stock monitoring
e.g. move zones
e.g. time of fishing, targeting
Ecological risk
Fishery risk
Fisheries management risk


STEP 1
Identify physical ocean change
Identify ecological effects
Ecological risk score
STEP 2
Determine potential fishery (adaptive) responses
Identify impact of social and economic (adaptive) responses
Fishery risk score
STEP 3
Determine potential management responses
Identify costs and speed of management responses
Management risk score
Overall risk assessment score

Drivers: Ocean properties changing

STEP 1

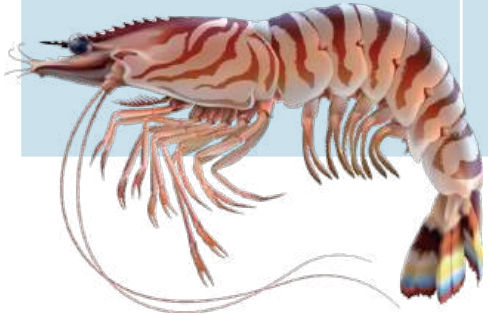
Temperature	Chemistry	Physical	Atmosphere	Extreme Events	Timing & Nature Events
• Sea surface temperature • Deep water temperature	• pH (acidification) • Salinity • Dissolved oxygen	• Sea level • Wave height & direction	• Alongshore wind speed • Air temperature • Rainfall & runoff	• Drought • Flood • Fire • Cyclones (extreme storms) • Heat wave & cold snap	• Seasonal shift • Ocean circulation • Upwelling • Stratification • Sea ice extent



Ecological responses

STEP 1

Abundance	Distribution	Phenology	Physiology/Quality
• Fecundity • Recruitment period • Average age maturity • Generalist vs specialist	• Larval dispersal • Juvenile/adult movement • Tolerance (preferred conditions) • Spatial availability of habitat	• Enviro. as cue for reproduction • Enviro as cue for settlement • Temporal mismatch (e.g. with food) • Migration	• Fat and muscle content • Body size • Metabolic capacity • Physiological tolerance & response curve • Activity level • Metabolically costly activities • Efficiency of uptake & energy conversion • Disease/parasite load



STEP 1

Risk factors	Levels	Abundance	Distribution	Phenology/ timing	Quality
Predicted direction of change	Positive (good) Negative (bad) Absent				
Intensity of the change	Very large Large Medium Small				
Speed of the change	In the next 2 years In the next 2-5 years In the next 5-10 years More than 10 years				

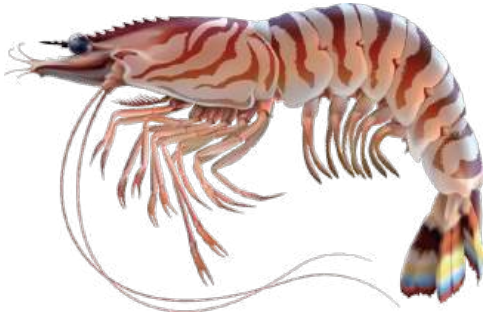


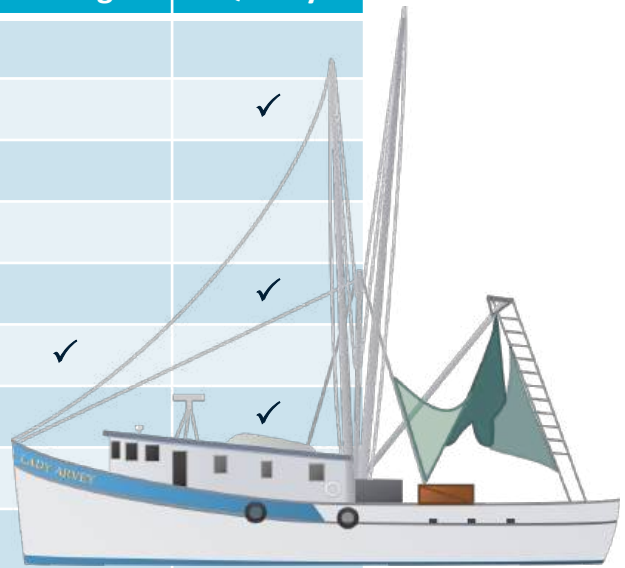
Table A: Ecological risk

	Negative Direction of Change				Positive	Absent
	Intensity of Change					
Speed of Change	**Very large**	**Large**	**Medium**	**Small**		
Next 2 years	High	High	High	Low	Low	None
Next 2–5 years	High	High	Medium	Low	Low	None
Next 5–10 years	High	High	Medium	Low	Low	None
More than 10 years	High	High	Medium	Low	Low	None

STEP 2

Potential fisher responses (adaptation)

Response	Abundance	Distribution	Timing	Quality
Change effort	✓	✓		
Move location	✓	✓		✓
Switch species	✓	✓		
Stop fishing	✓	✓		
Invest (new tech or assets)	✓			✓
Trade quota (catch or effort)	✓	✓	✓	
Shift pricing	✓	✓		✓
Manage supply chain	✓	✓		
Improve fish handling practices				
Target & diversify markets	✓	✓	✓	✓
Value add	✓			✓
Accessing Information (inward focus)	✓	✓	✓	✓
Information dispersal (outward focus)	✓	✓	✓	✓



Response risk

Social and economic impacts vs Available options

Table B: Response risk

Options available		Economic or social impact (whichever is LARGER)			
	Implementation	Very large	Large	Medium	Small
Few	Easy	High	High	High	Medium
	Moderate	High	High	Medium	Low
	Hard / very hard	Medium	Medium	Medium	Low
Some	Easy	High	High	Medium	Low
	Moderate	High	High	Medium	Low
	Hard / very hard	Medium	Medium	Low	Low
Many or very many	Easy	High	High	Medium	Low
	Moderate	Medium	Medium	Low	Low
	Hard / very hard	Medium	Medium	Low	Low

Fishery risk

High fishery risk

Medium fishery risk

Low fishery risk

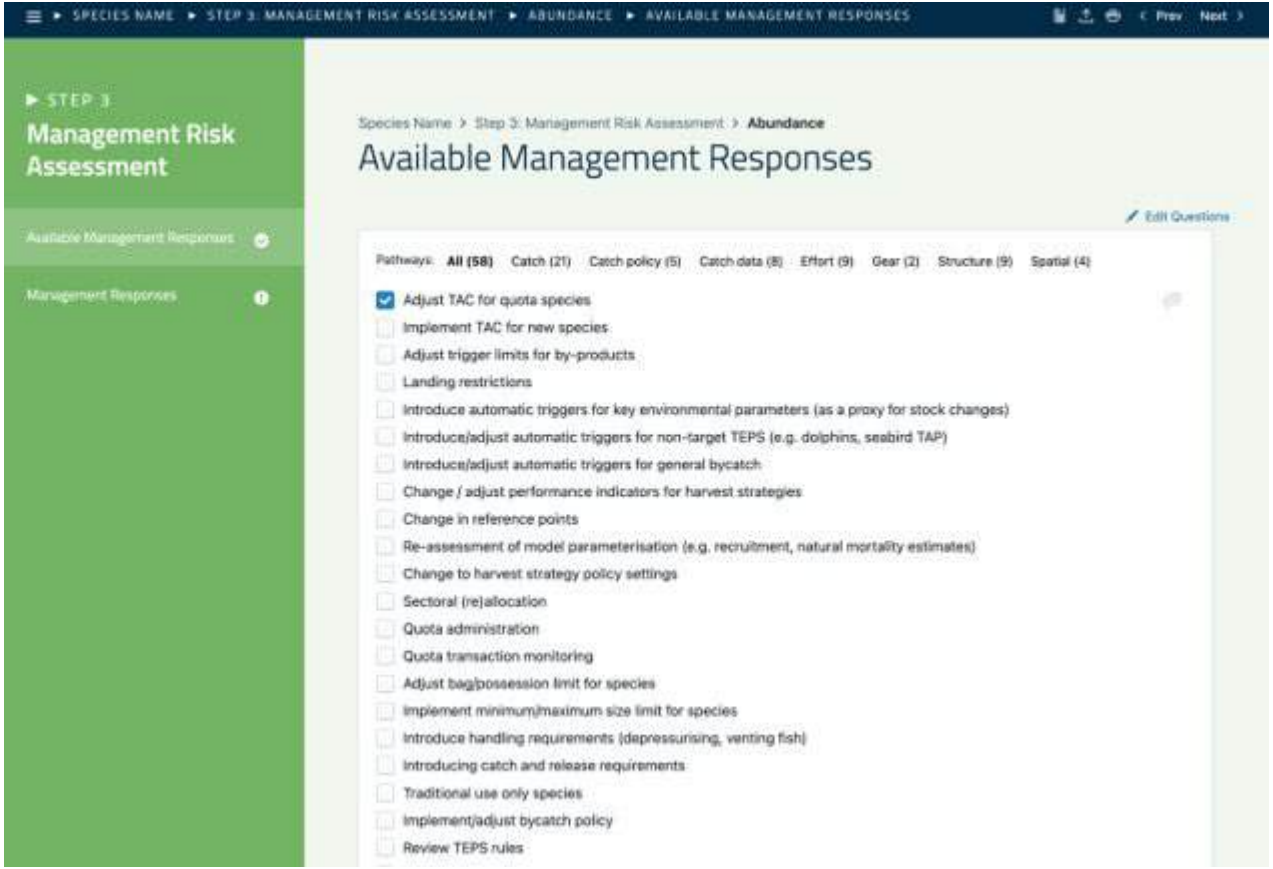
Table C: Fishery risk

	Response risk		
Ecological risk	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low
Absent	None	None	None

Available Management Responses

STEP 3

- Select by Ecological Risk
- Formal (matters of law) and informal
- Sort by Pathways to Influence:
  - Catch
  - Catch policy
  - Catch data
  - Effort
  - Gear
  - Structure
  - Spatial

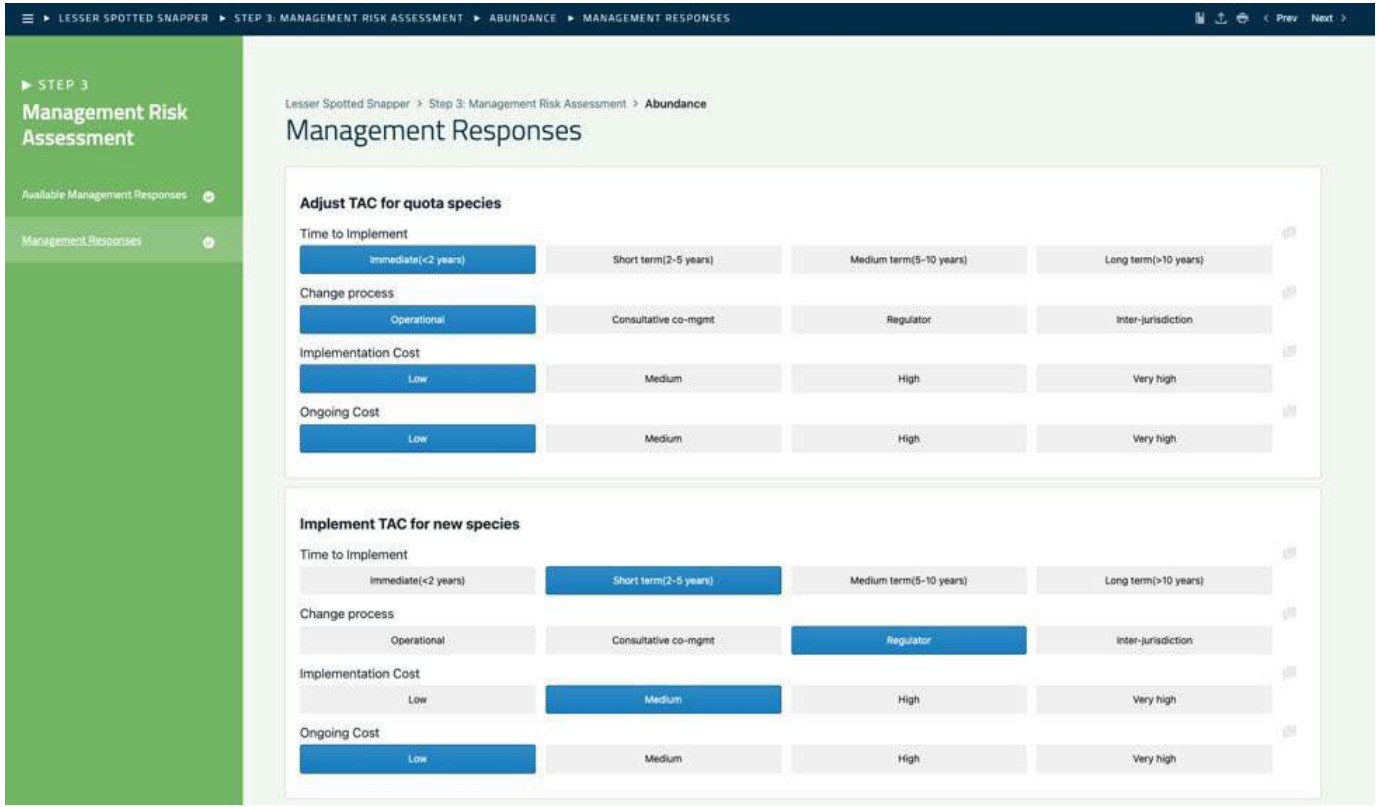


Management response

STEP 3

Risk factors:

- Time to Implement
- Change process
- Implementation cost
- Ongoing cost



STEP 3: ASSESS MANAGEMENT RISK

STEP 3

Determine the list of potential management responses and score them based on time to implement, how difficult it will be to change the relevant management processes or policies, and any associated implementation or operational costs. Cross reference the scores for the number of tools available, change process and time to implement to get the pathway risk score.

Table D: Pathway risk

Tools available	Process and pathway	Time to implementation			
		Long	Medium	Short	Immediate
Few options	Inter-jurisdictional	High	High	High	High
	Regulator	High	High	High	Medium
	Consultative group	High	Medium	Medium	Medium
	Operational	High	Medium	Low	Low
Some options	Inter-jurisdictional	High	High	High	Medium
	Regulator	High	Medium	Medium	Medium
	Consultative group	High	Medium	Medium	Low
	Operational	High	Medium	Low	Low
Many options	Inter-jurisdictional	High	High	High	Medium
	Regulator	High	Medium	Medium	Low
	Consultative group	High	Medium	Low	Low
	Operational	High	Medium	Low	Low

Then cross reference the pathway score and the cost scores to get the base management risk score.

> Pathway risk from Table D

Table E: Base management risk

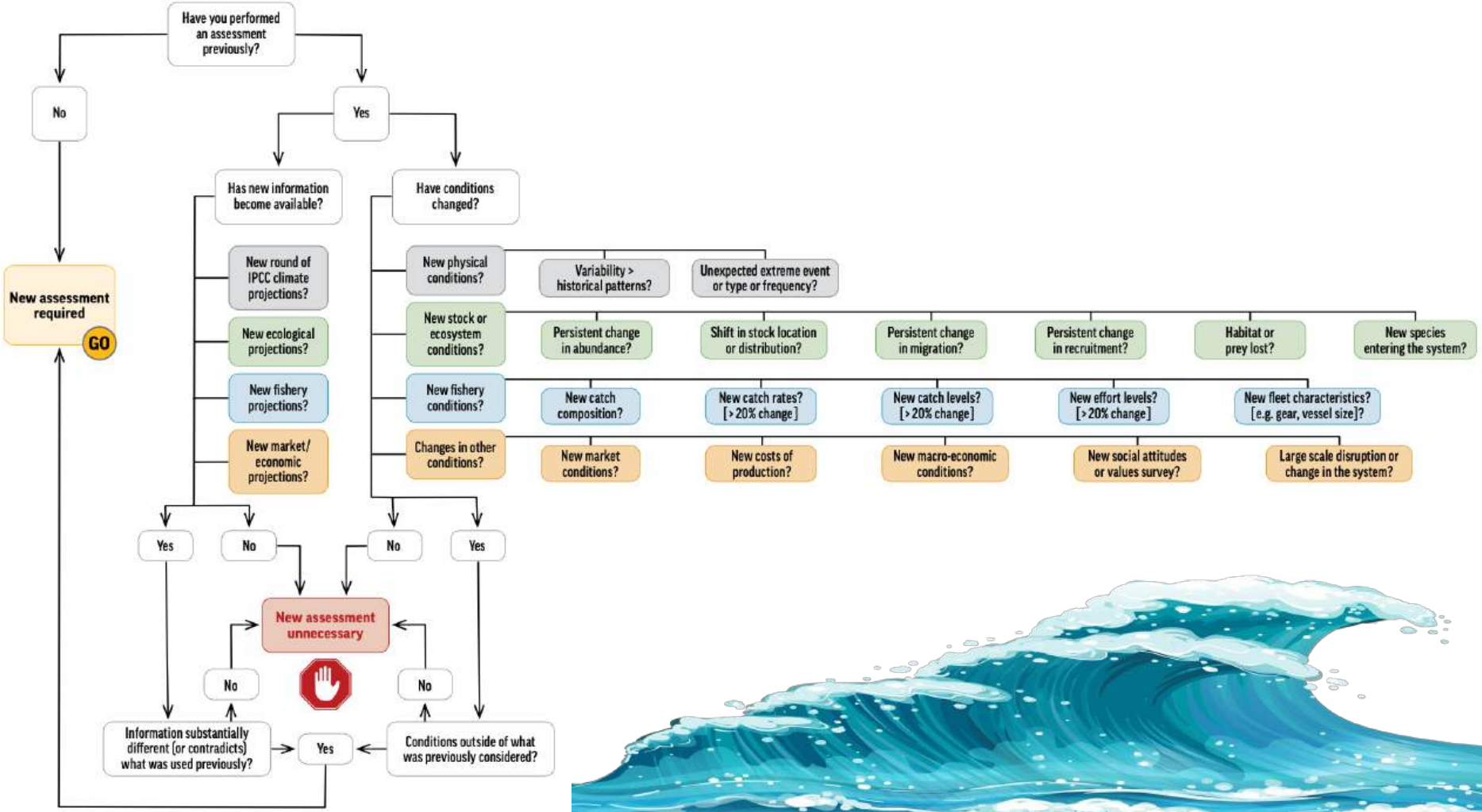
	Cost (implementation & ongoing, whichever is LARGER)			
Pathway risk	Very high	High	Medium	Low
High	High	High	Medium	Medium
Medium	High	High	Medium	Low
Low	Medium	Medium	Low	Low

Lastly, cross reference the base management risk score and ecological risk score to get the final fishery management risk.

> Ecological risk from Table A
> Base management risk from Table E

Table F: Fishery management risk

	Base management risk		
Ecological risk	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low
Absent	None	None	None


Have you performed an assessment previously?
No
Yes
Has new information become available?
Have conditions changed?
New assessment required
GO
New round of IPCC climate projections?
New ecological projections?
New fishery projections?
New market/ economic projections?
New physical conditions?
Variability > historical patterns?
Unexpected extreme event or type or frequency?
New stock or ecosystem conditions?
Persistent change in abundance?
Shift in stock location or distribution?
Persistent change in migration?
Persistent change in recruitment?
Habitat or prey lost?
New species entering the system?
New fishery conditions?
New catch composition?
New catch rates? [> 20% change]
New catch levels? [> 20% change]
New effort levels? [> 20% change]
New fleet characteristics? [e.g. gear, vessel size]?
Changes in other conditions?
New market conditions?
New costs of production?
New macro-economic conditions?
New social attitudes or values survey?
Large scale disruption or change in the system?
Yes
No
No
Yes
New assessment unnecessary
No
No
Information substantially different (or contradicts) what was used previously?
Yes
Conditions outside of what was previously considered?

Tool - Roll out and capability-building (project 2)

Tool diffusion (project 2)

Objectives:

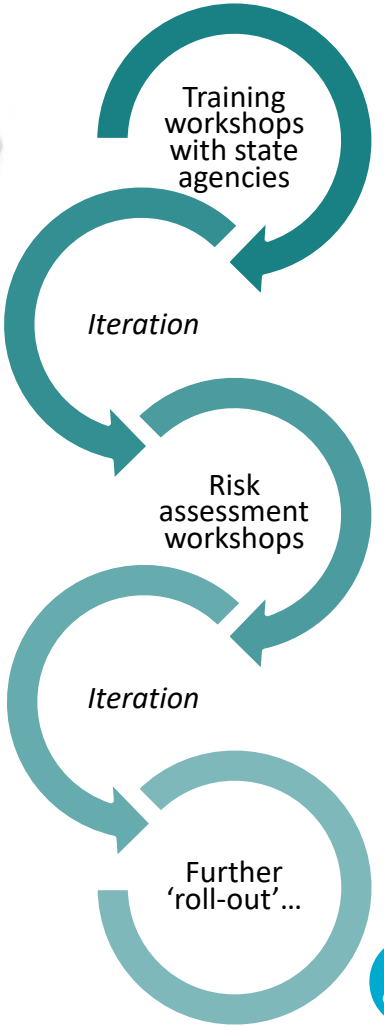
1. Complete training of relevant personal in each state/territory fisheries management agency regarding the fisheries climate adaptation handbook

2. Complete an assessment of a fishery per state/territory as a demonstration of the fisheries climate adaptation handbook in that jurisdiction

Mud Crab Fishery (NT)

Rock Lobster Fishery (TAS)

Demersal Scalefish Fishery (WA)



CSIRO

So what have we learnt? Reflections & feedback

Current socio-cognitive conditions matter (a lot)

Observation:

Strong prevailing social norms are present and include:

- Effects being felt are due to multiple (non-climate, temporary) factors
- Response to ecological risk is ‘We’re used to variability so a bit more won’t be a problem’
- Climate risk isn’t a well recognised risk so can’t justify management changes

Insights and responses:

- Socio-cognitive conditions are critical to effective decision-support
- Design of the workshops contributes to social learning - Re-design workshops to support re-framing and mental preparedness
- Psychological support is important - have to find some “glass half full” opportunities as well as discussing hard truths

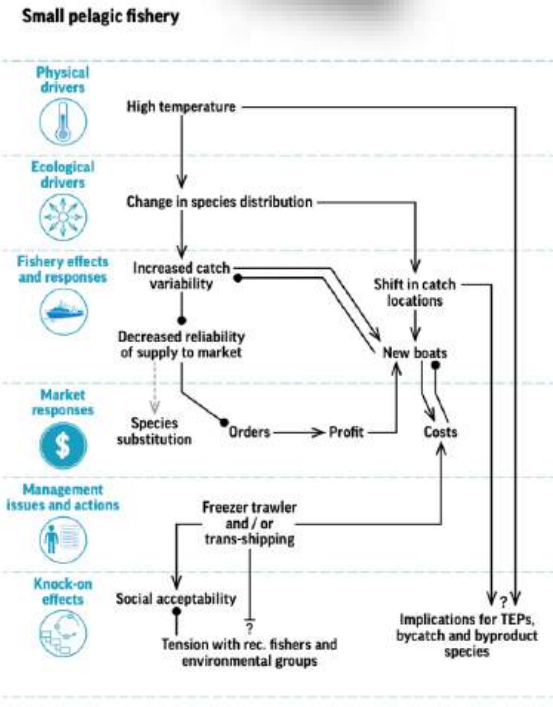
Cognitive over-load needs managing

Observations:

- Managers/fishers are tackling many large problems - default socio-cognitive mode is to try to handle one issue at a time ("siloed thinking")
- Prevents leveraging the opportunity to make multiple gains and leap ahead
- Recently completed reforms leave little appetite for further change, let alone transformations

Insights and responses:

- Use narrative devices and impact pathways as an initial exploration of multiple casualty
- Highlight maladaptation and opportunity cost of not responding



Priming in futures ‘thinking’ is necessary

Observations:

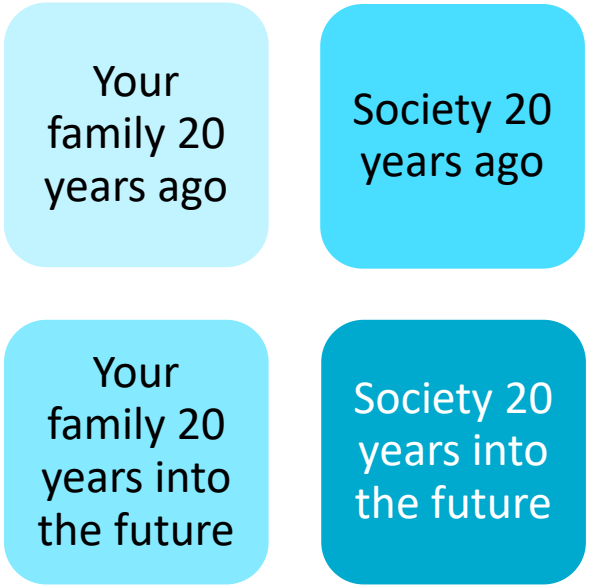
Current mental frames limit consideration of:

- fishery collapse or closure
- ‘out of the box’ responses
- ‘windows of opportunity’ for transformation

Insights and responses:

- Workshops need to include priming exercises in futures ‘thinking’ early on
- Treating undesirable ‘step-change’ or regime-shift type futures as hypothetical scenarios (“let’s just imagine this happened…”) can help remove the fear or avoidance of these impact pathways

Write down 5 things about what life was/will be like for…



What has been and will be the degree of change in things you care about?

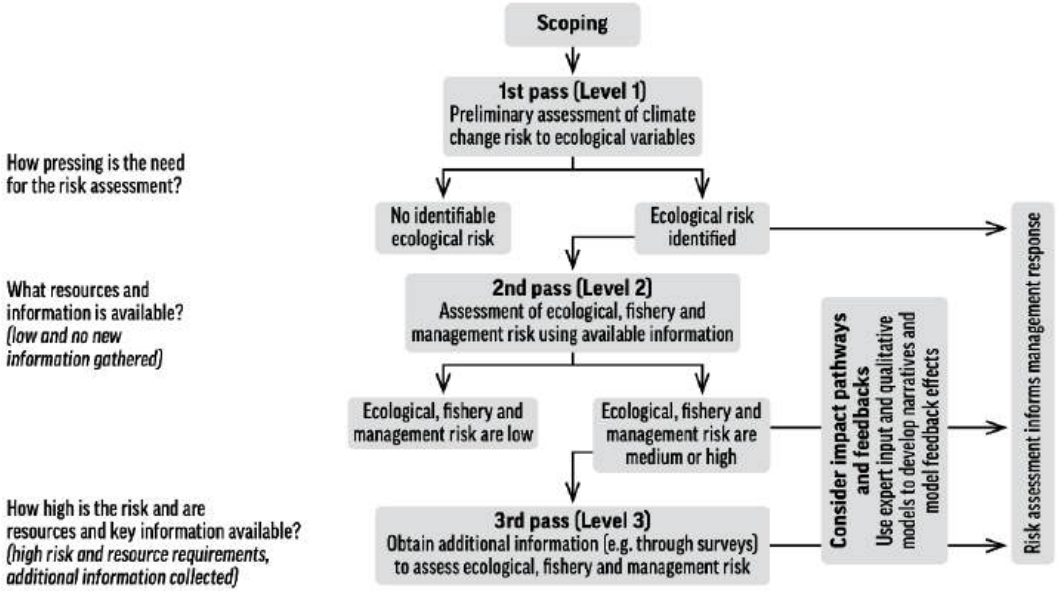
Observations:

- Data gaps and emerging (uncertain) understanding treated as barriers
- Co-production of risk assessment doesn't always occur

Insights and responses:

- Prioritise data gaps
- Co-production (as opposed to engaged research) isn't always necessary
- Expert elicitation methods can produce sufficient knowledge
- Establish a new social norm that it's ok to learn things wrong first then re-learn as new knowledge emerges (which it will)

Options exist to address limited data and emergent/ changing understanding



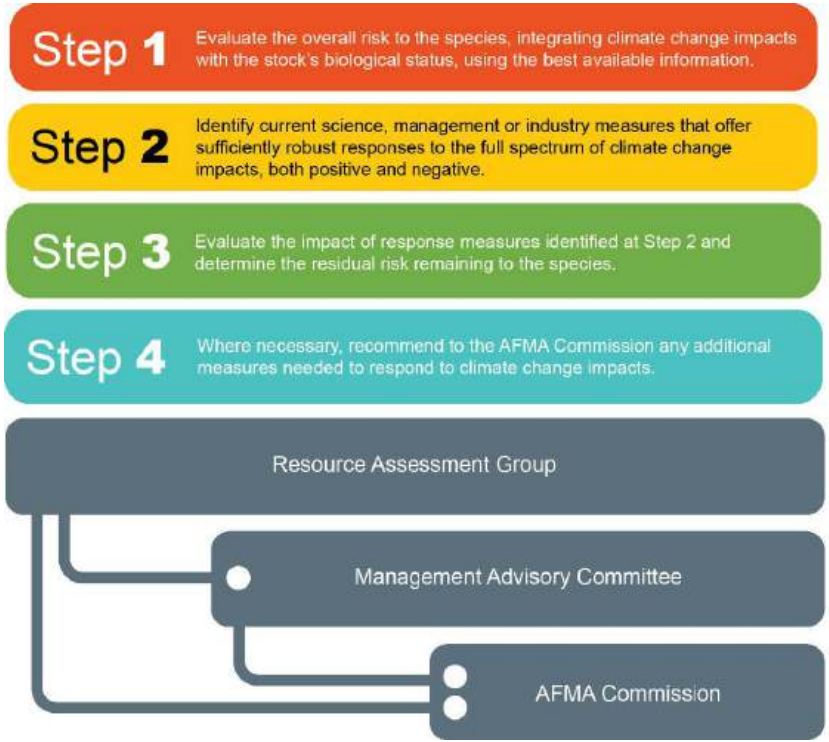
Users need agency and a formal mandate, ultimately

Observations:

- Not always clear who has responsibility within an agency for the risk assessment (if any)
- Handbook perceived as a failure by some users because it flags issues and options but doesn't produce the implementation step (which is beyond the science scope)

Insights and responses:

- Expectation management is needed
- Uptake and commitment is increased by formal mandate (see 2025 AFMA framework)
- Researchers, managers, fishers (and potentially policy makers) need to be involved for it to have best effect



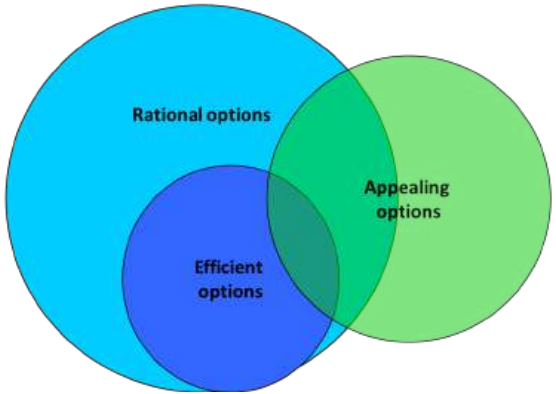
https://www.afma.gov.au/climate-change | Australian Fisheries Management Authority

Best use of tools varies based on user capacity

Observations:

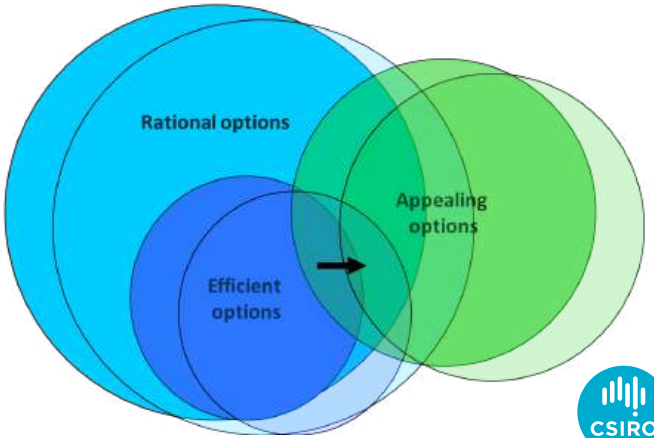
Major variation in:

- Active reform of fisheries management
- Whether agencies have a formal mandate to assess and act
- Human and knowledge capacity



Insights and responses:

- Not all agencies are ready for full assessments
- Collaborations with dedicated science team necessary
- Combine online with f2f modes
- Stream breakout groups; apply targeted elicitation practices
- Simpler variants of tools – needs to be flexibility for users to modify as needed



Sea Change Australia (project 3)

Sea Change Australia (project 3)

Understanding the human and institutional aspects that affect agility/capacity to adapt (rather than assessing risks) + enabling knowledge sharing

https://seachangeaustralia.org/

Fishing for Climate Answers – Q&A Platform: https://seachangeaustralia.org/qa-platform/

ClimateToolbox: https://seachangeaustralia.org/climate-toolbox/

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