

Developing adaptation pathways for climate-impacted and at risk fisheries in south-east Australia

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Biological changes well documented for south-east Australia....



Poleward expansion of sea urchins causing loss of kelp forests in Tasmania (*Ling et al 2009*)

50% intertidal species monitored have moved poleward in Tasmania over last 50 years (*Pitt et al 2010*)



Changing composition of phytoplankton blooms – increased tropical species and red tides (*Thompson et al 2009*)

Changes in rock lobster recruitment, catch and distribution correlated with regional SST changes (*Pecl et al 2009*)

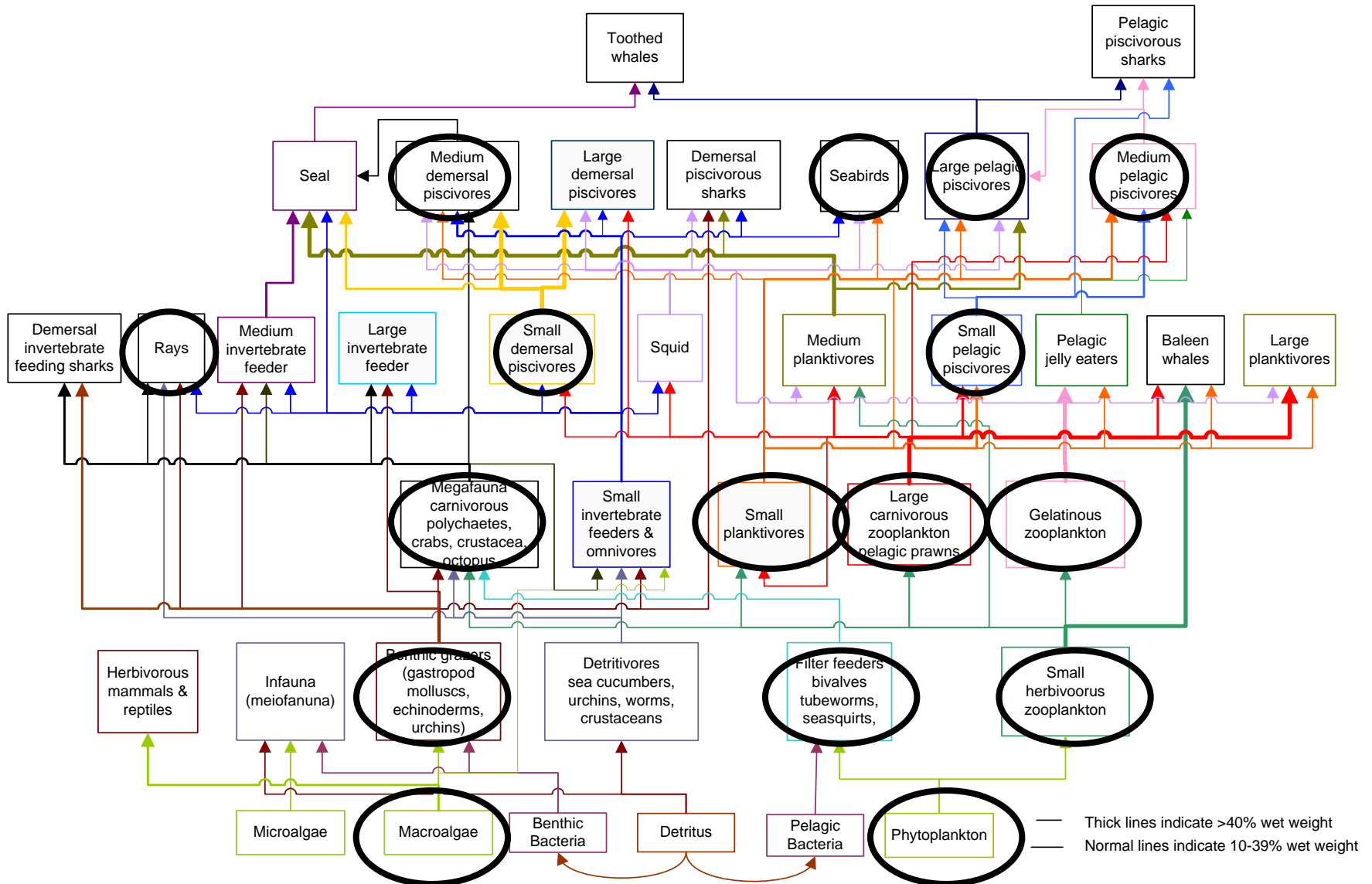


Over 60 coastal fish species exhibited major distributional changes in Tasmania (*Last et al 2011, Robinson et al 2015*)

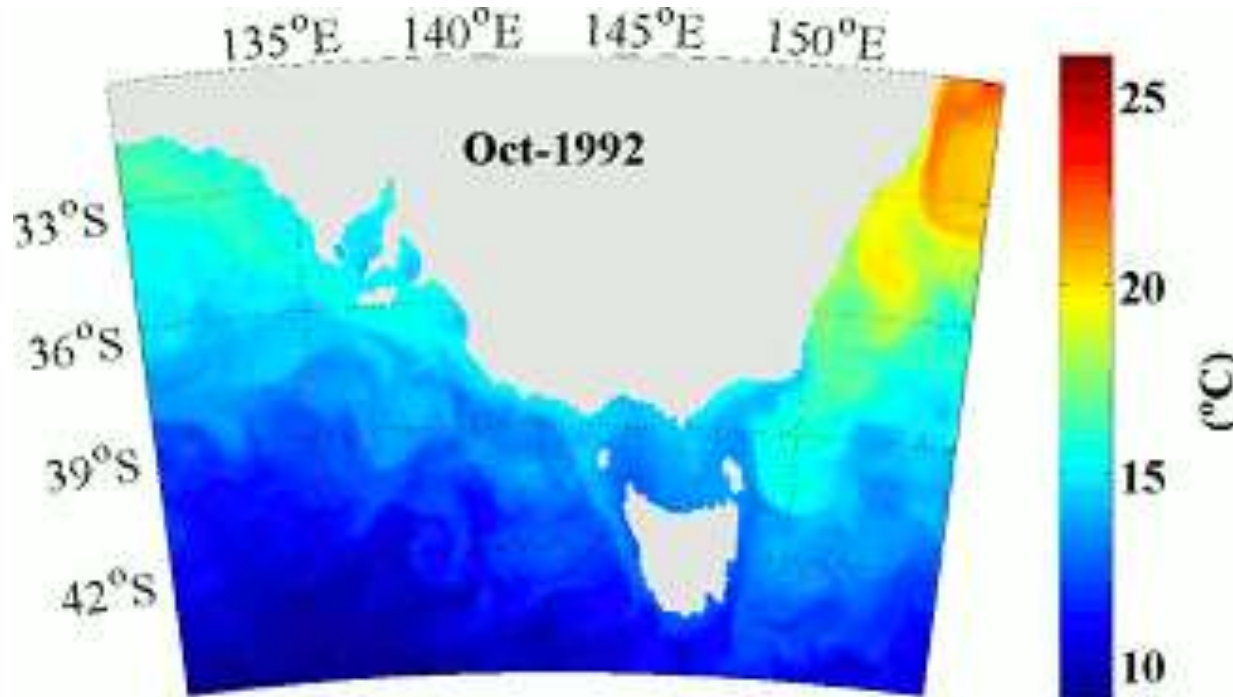
85% of seaweeds found further poleward on east coast from 1940 (*Wernberg et al 2011*)



...and occur through-out the food web



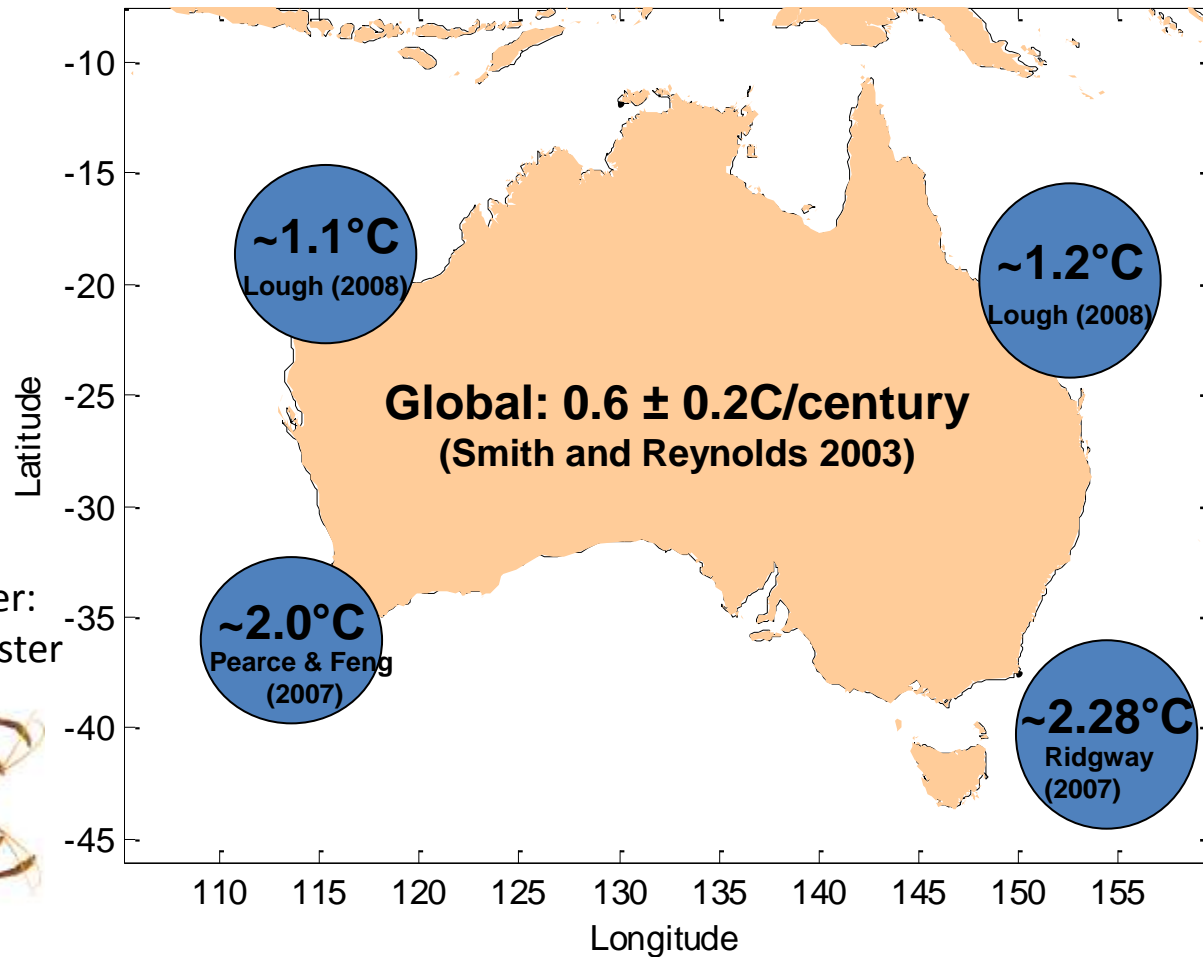
East Australian Current (EAC) pushing further south & persisting for longer



Westerly winds south of Australia are intensifying & 'spinning up' the anticlockwise circulation around the South Pacific.

One of the fastest warming regions globally and will likely remain so in the future.

Sea surface temperature changes (per century)



Nick Caputi poster:
western rock lobster



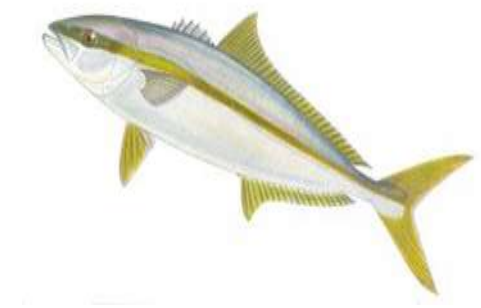
SE Australia- a natural laboratory?

- Area of high exposure to key climate driver - temperature
- Produces 50% of Australia's seafood - concern regarding commercial fisheries
- High no. of endemics and areas of high conservation value
- Significant interest from Government, research & industry communities
- Global Marine Hotspots Network
www.marinehotspots.org



Fisheries in SE Australia

- Low productivity (by international standards), only minor upwelling
- Main group by value lobsters, by volume Australian sardines
- High value catch largely exported to Asia (lobster and abalone)
- Fisheries mostly “output controlled”
 - Quotas, access rights, emphasis on spatial management
 - “inflexible”
- Form of co-management (via stakeholder input on various ministerial and management advisory committees)
- High participation rate in recreational fishing, boating & diving
- Significant conflict:
 - Recreational and commercial fishers
 - Fishers and conservation (eg MPA's)



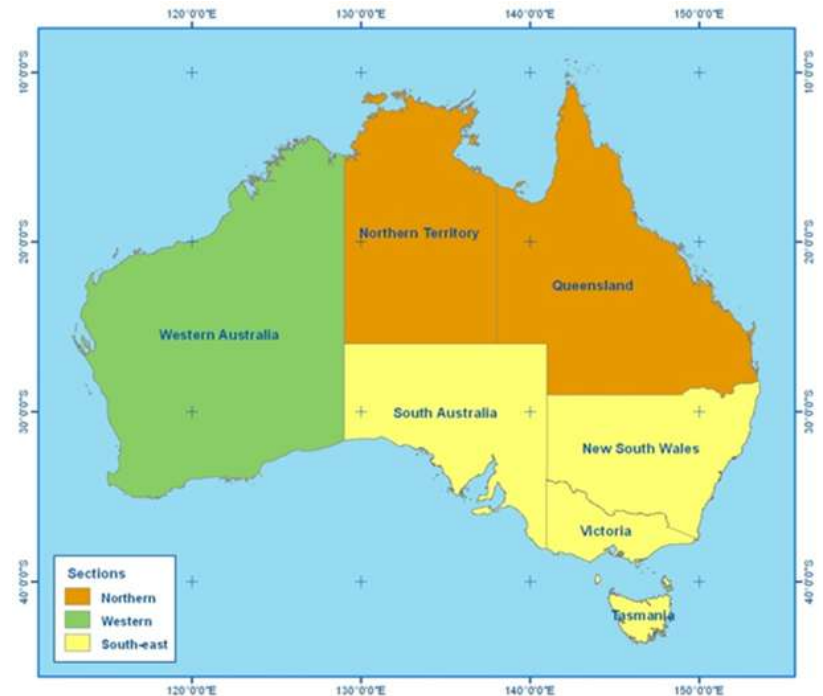
Fisheries adaptation in Australia

- Autonomous adaptations & anticipatory planned responses/adaptation actions
 - Stewart Frusher – coastal fisheries
 - Alistair Hobday – pelagic fisheries
- Government and industry interest in medium/longer term adaptation planning
 - Climate-impacted fisheries
 - 'At risk' fisheries
- Evaluating adaptation options – Emily Ogier poster
- Possible adaptation planning in other components of fishery-system
 - Éva Plagányi– identify critical elements in the seafood supply chain (example not from SE Australia)

Coordination of response to cc

Multiple agencies (& associated documents) in coordination & research provision

- **National Adaptation Research Plan (NARP) for Marine Biodiversity and Resources**
 - National Climate Change Adaptation Research Facility (NCCARF) & Department of Climate Change and Energy Efficiency (DCCEE)
- **National Climate Change & Fisheries Action Plan (NAP)**
 - Department of Agriculture Fisheries & Forestry (DAFF)
 - South-East Australia Program (SEAP)
 - Northern Tropical Australia Program
 - Western Australia Program



Australian Government
Department of Agriculture,
Fisheries and Forestry



Australian Government
Fisheries Research and
Development Corporation

Broad, integrated and interdisciplinary approach to assessing risk and response to cc

Single species



Species Interactions



Assemblages



Fisheries

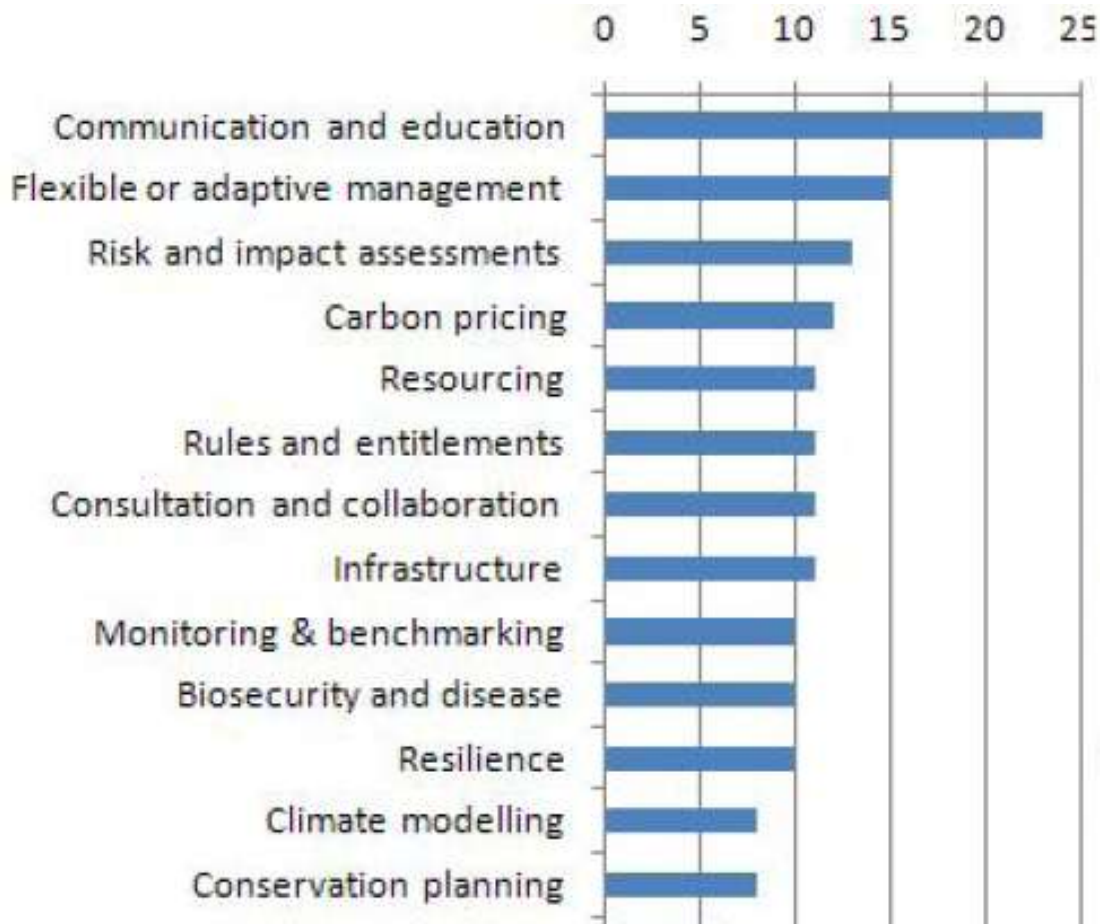


Management & adaptation



← Communication with community & industry →

Marine stakeholder priorities for adaptation

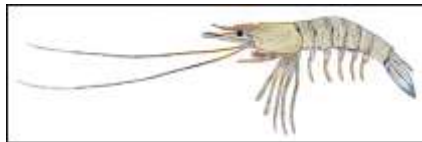
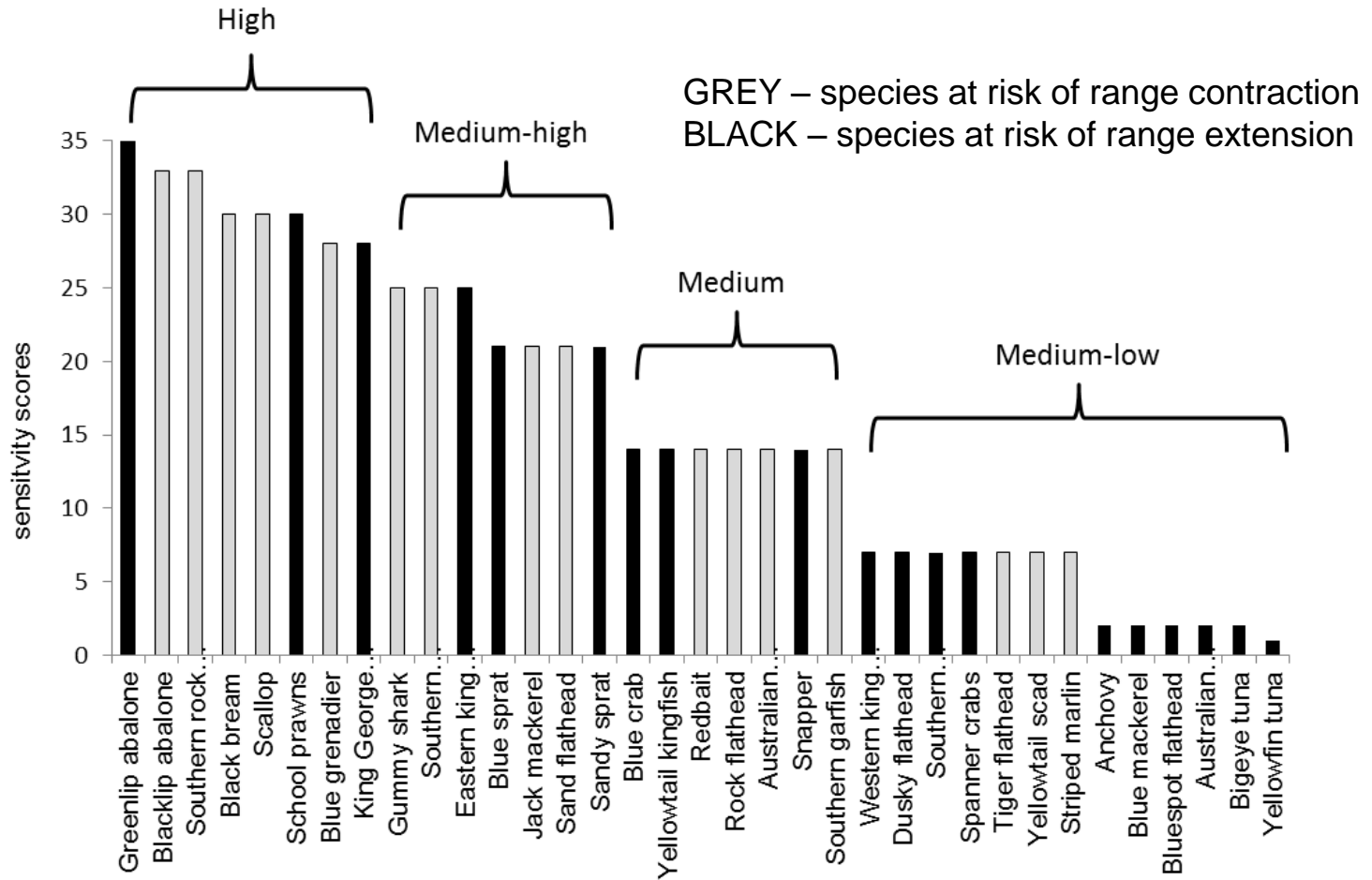


Communication and trust is key

- “Its not happening” or “Changes are not associated with CC” (see Nursey-Bray et al 2012, Marine Policy)
 - “We already adapt”
 - “There are more important/immediate issues”
 - Even small changes become highly politicised
-
- Information sheets
 - Industry and community presentations
 - Papers/Reports
 - U-Tube
 - Interactive websites
 - Industry newsletters
 - Involvement in workshops & citizen science
 - TWO way communication!!!
 - Regular & consistent communication



Relative sensitivity to CC rankings for key species (distribution, abundance, phenology)



Species selected for development of targeted & planned adaptation strategies

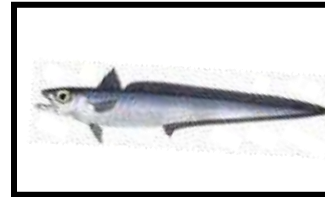
Abalone (H)



Southern rock lobster (H)



Blue grenadier (H)

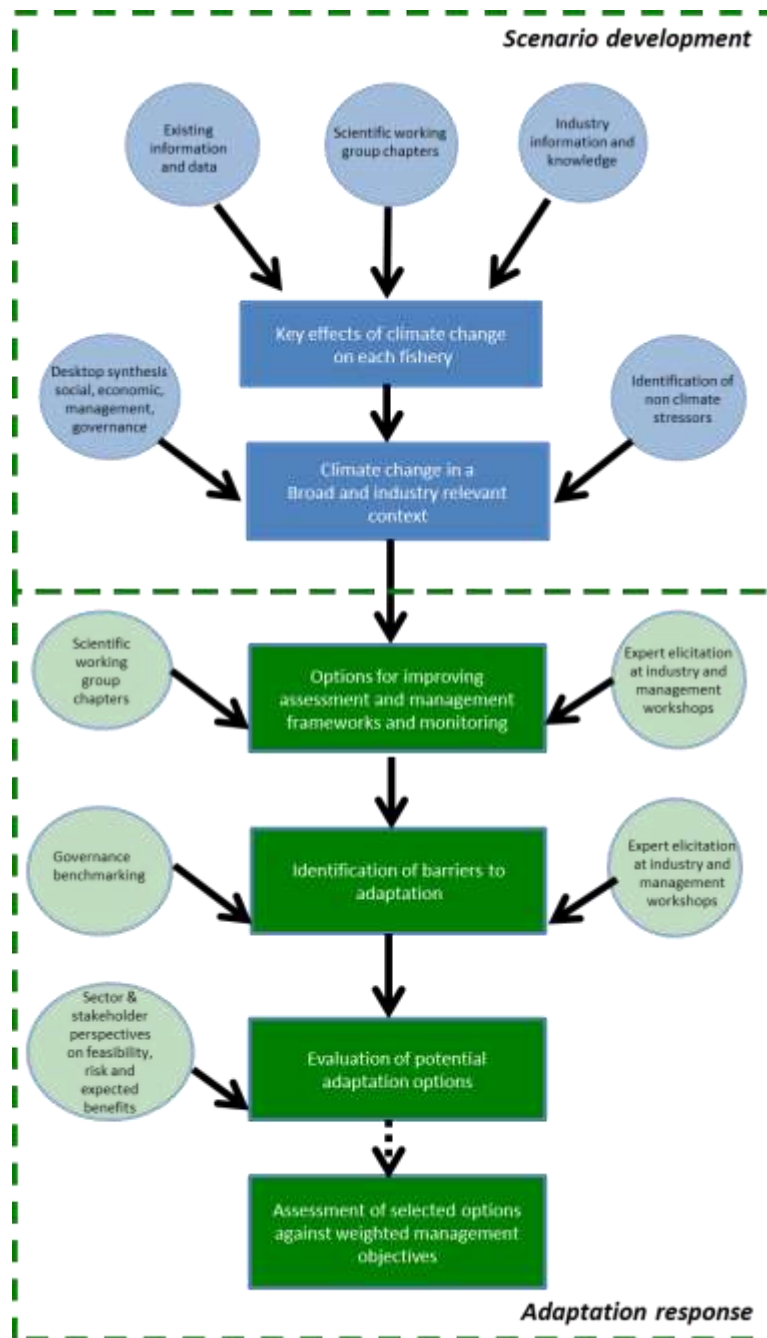


Snapper (M)

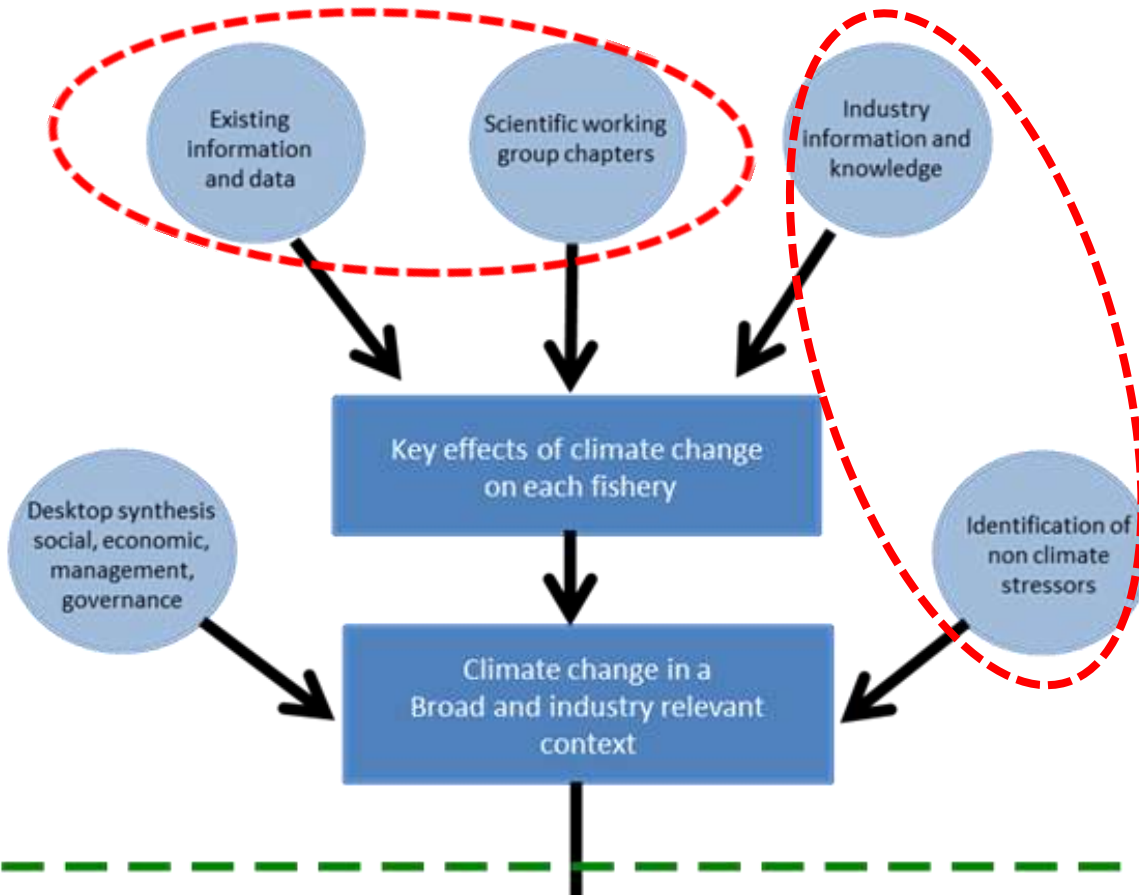


- Sensitivity - high or medium risk to climate change impacts
- High commercial value and/or recreational importance
- Rock lobster and abalone considered potential ecological indicators for rocky reefs
- Snapper is an important component of the coastal fish assemblages that occur in the region's estuaries and large embayments
- Blue grenadier highest risk commonwealth species
- Likely to exhibit different responses
 - Declines in abundance
 - Shift in resource distribution at small (between communities) and large (between jurisdictions) spatial scales
 - Shifts in temporal patterns (timing of spawning/moulting)
 - Increases in abundance
- Different industry and sectoral features
- Different management systems

Pecl et al 2014c. Preparing fisheries for climate change: identifying adaptation options for four key fisheries in South Eastern Australia. FRDC Project 2011/039



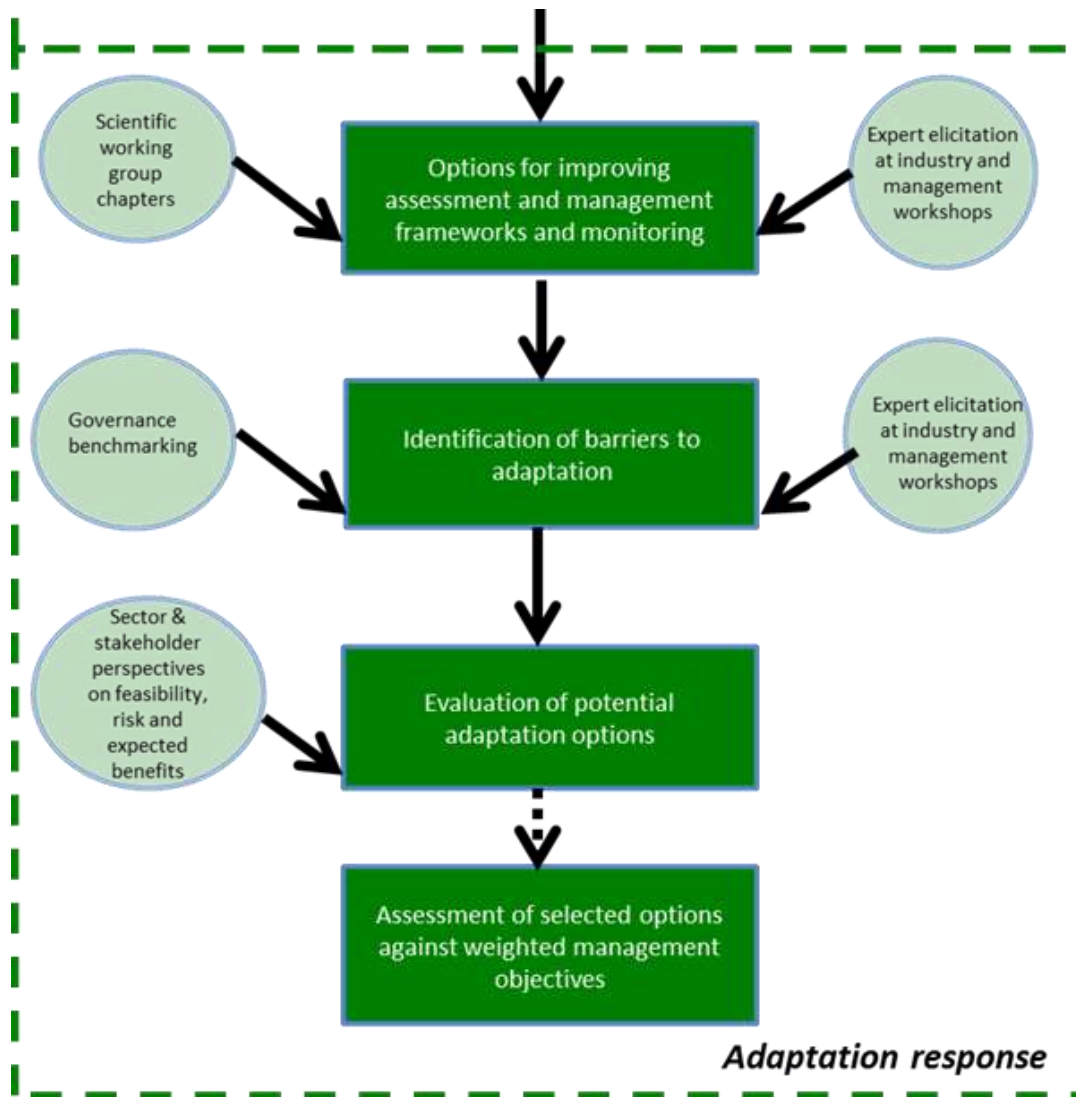
Scenario development



- Stock assessment & harvest strategy
- Soliciting industry knowledge concerning oceanographic, ecosystem or fishery changes
- Putting climate change into perspective by asking industry and managers to identify key stressors to the fishery

Developing conceptual scenarios with managers, industry & researchers

- Detail likely climate challenges
- Eliciting likely autonomous adaptations (what CAN you do)
- Generate potential planned adaptation options (what would you LIKE to do but CAN'T)



Adaptation options generated:

- Science teams
- Elicitation from industry & managers

Barriers to adaptation:

- Identified by 'governance benchmarking for effective fisheries management' (planning, accountability, transparency, adaptability, incentives, knowledge)
- Elicitation from industry & managers

Broader marine governance

(from Pecl et al 2014)

- International obligations
- Environmental legislation
- Cost recovery policy

Fisheries governance

- Fisheries management policy
- Fisheries management legislation:
 - Fisheries legislative objectives
- EBFM policy
- Market-based governance

Fishery management

- Management Plan :
 - Fishery-specific management objectives
 - Rules and regulations
 - Management instruments and tools
- Compliance and enforcement
- Property rights arrangements
- Co-management arrangements
- Allocation arrangements

Operational framework

- Harvest strategy:
 - Operational objectives
 - Performance indicators
 - Limit and target reference points
 - Defined acceptable levels of risk for the fishery
 - Monitoring strategy
 - Decision rules that control the intensity of fishing activity
- Stock assessment

How does climate change intersect with the various components and levels of the fishery management system?

- Impacts
- Levers to pull
- Barriers to action

**LOTS OF WORKSHOPS,
SURVEYS & MEETINGS!
Highly participatory process**



Adaptation options - Characterisation

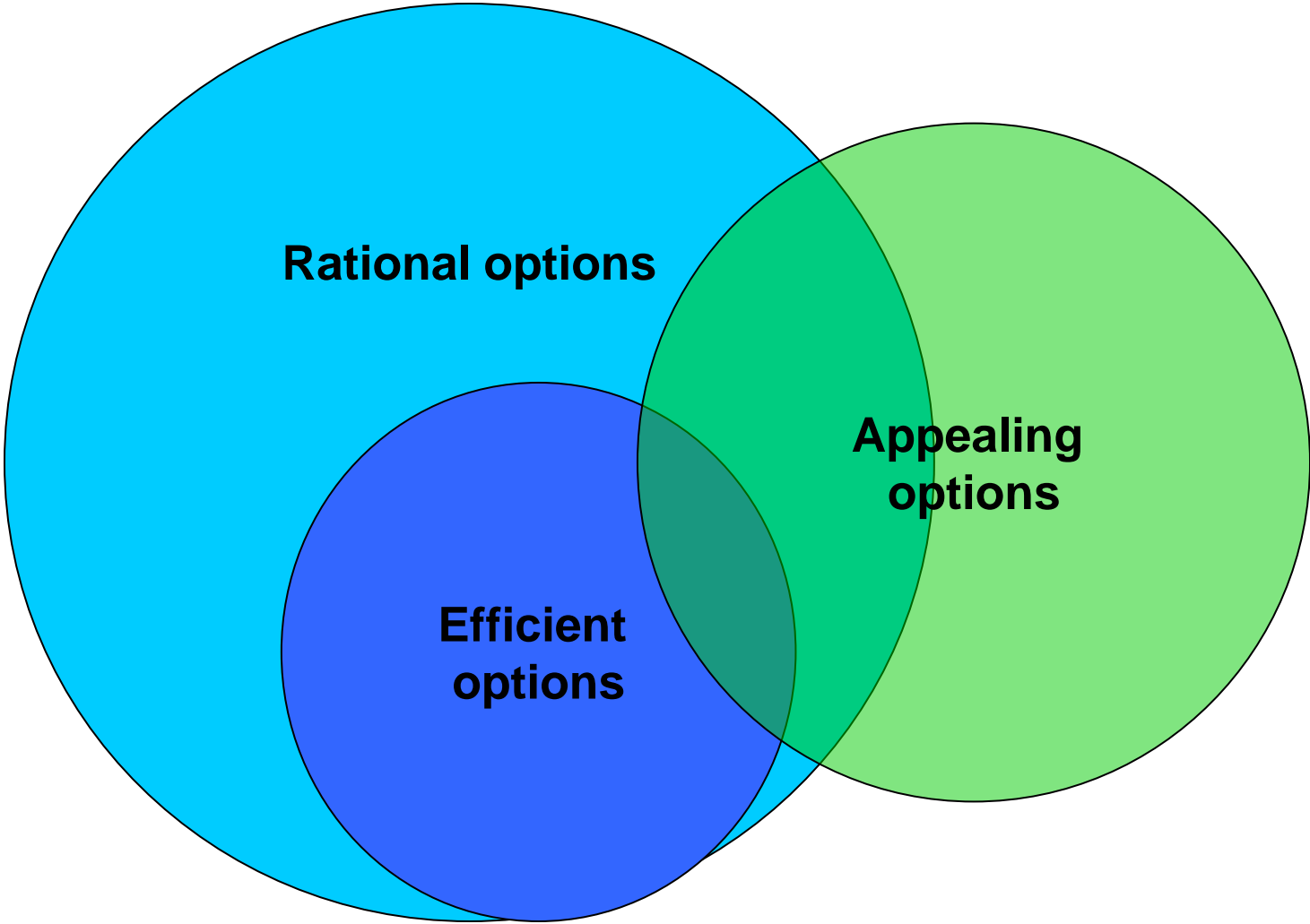
Is this option one industry can implement independently or does it require minor, moderate or radical change to the fishery's governance?

- Autonomous adaptation
 - Can occur without any interaction with management

Directed

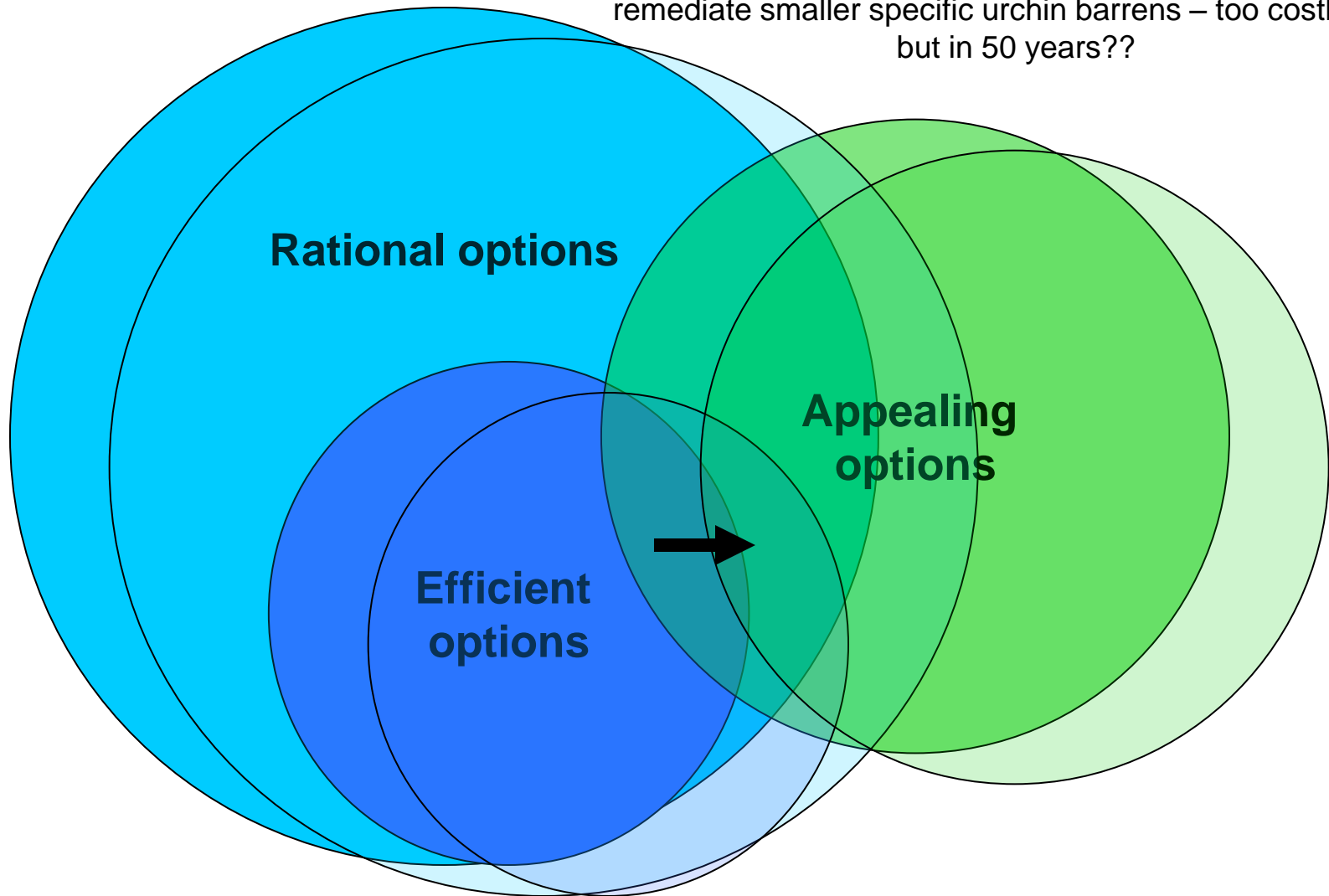
- Business-As-(Mostly)-Usual (**retro-fitting existing structures for cc**)
Involves no/minor changes to existing management and operational arrangements
- Incremental
Involves moderate changes to existing management and operational arrangements
- Transformative
Involves radical shift in resource management and utilisation

With climate change, options change..



With climate change, options change..

e.g. Translocation of larger lobsters into specific areas to remediate smaller specific urchin barrens – too costly now, but in 50 years??



Goalposts for adaptation - Identifying weighted management objectives

- Understanding what values a fishery system is being managed for
- How different groups of stakeholders (or jurisdictions) weight objectives
- GOALPOSTS for adaptation – rather than ‘less bad’ or ‘better’ !!

1 Maximise wellbeing of communities

2 Maximise Economic Performance

3 Ensure Environmental and Ecosystem Values

4 Strengthen Management and Governance

- Different stakeholders have different objectives
 - Flag zones of conflict which may act as barriers to adoption and implementation of adaptation actions
 - Objectives determined through workshops
 - Relative importance established with post-workshop survey using Analytical Hierarchy Process
- (Jennings et al 2012)

Challenges & barriers to adaptation

- Divergent expectations from adaptation research
 - Managing agencies want information only (but no requirement to commit to change)
 - Public good funding agencies want management change
- Stakeholder burn out
 - Challenge in getting engagement, then challenge not to burn out
 - Too many competing demands on their time
 - CC not seen an immediate threat in contrast to other more immediate issues
 - We need to clearly communicate links and benefits
- Fear of increased costs of adaptation to managing agencies and fishers
 - Need to highlight opportunities for improving efficiencies
 - Look at funding models for monitoring programs & be clear about use & value of data

Self-reflection in SE Australia

Recent transition from single discipline impacts-focused research to an interdisciplinary systems view of adaptation research.

Facilitated by four preconditioning factors (Frusher et al 2014).

1. Early observations of rapid oceanic change
2. Biological change - together provided a focus for action
3. Strong marine orientation and history of management in the region
4. Presence of well developed research/industry networks

Critical role of inter-disciplinary engagement and stakeholder participation in supporting industry and government adaptation planning.

Thanks

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