CLIOTOP 3rd Symposium

(Climate Impacts On Top Ocean Predators)

- Abstracts - close March 31

- Climate and pelagic species
  - Special issue – just out
    - 26 papers from 2nd symposium (2013)

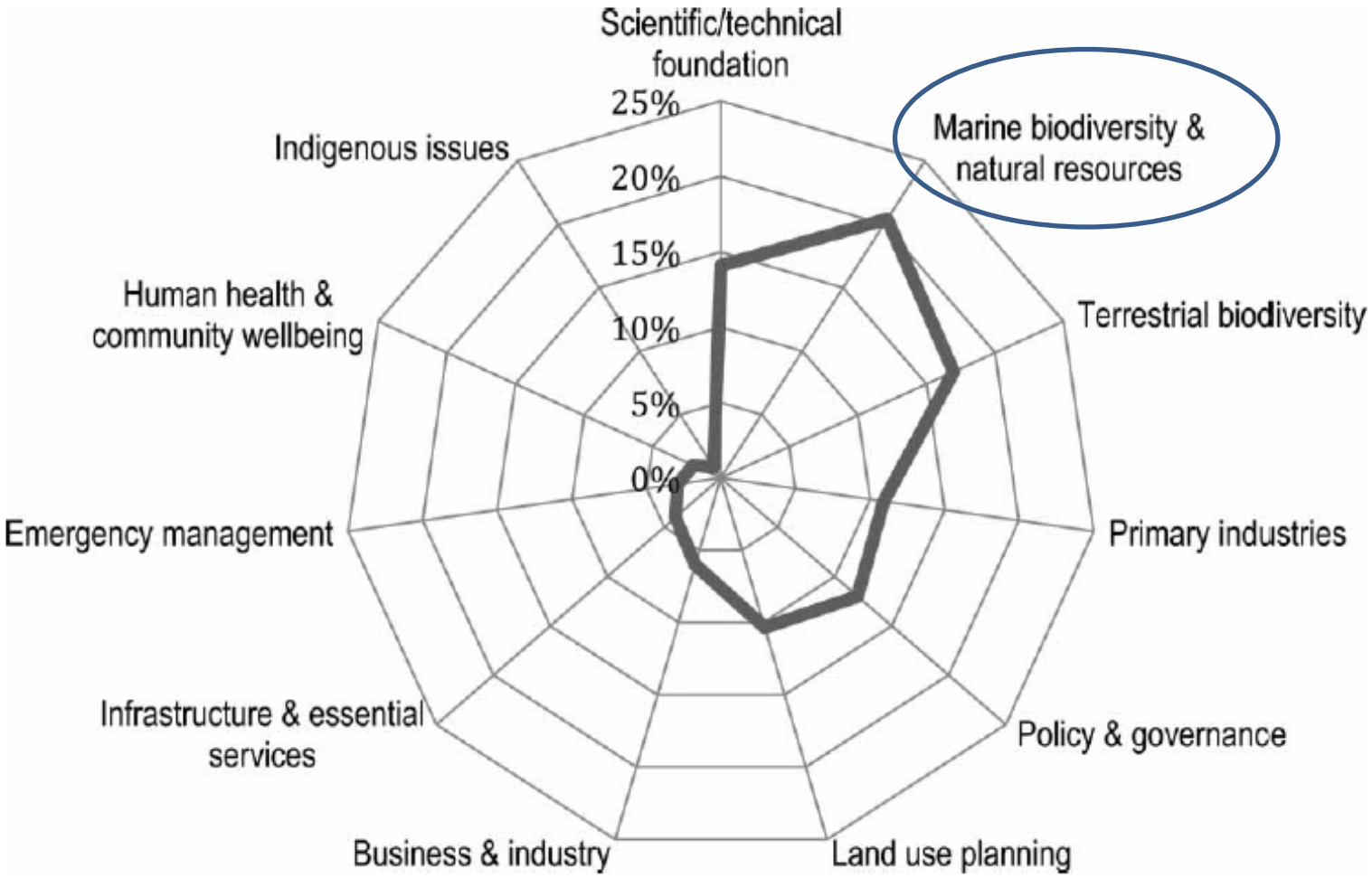
Adaptation in pelagic fisheries (south-east Australia)

Alistair Hobday, Jason Hartog, Paige Eveson, Claire Spillman, Gretta Pecl, Stewart Frusher

Adaptation Literature

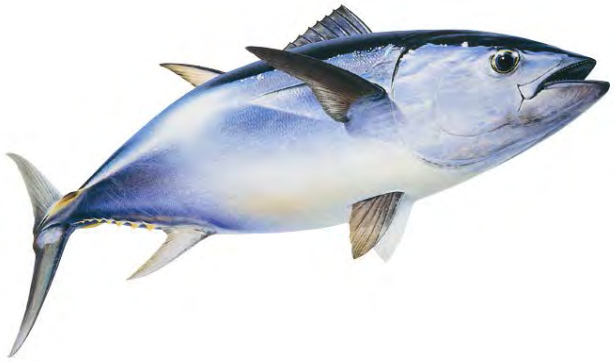
(Tasmania)

(Lyth et al 2015)



South-east Australia - Part 2

- Part 1 -coastal south-east Australia fisheries
  - Coastal climate change patterns
  - Adaptation options
    - Abalone
    - Rock lobster
    - Salmon
    - Oysters
    - HABS
    - Ecosystems



- What about pelagic species and fisheries?

Pelagic species

- Pelagic species - Tuna, billfish, sharks
- Pelagic fisheries - Longline, purse seine, pole and line (recreational)
- Historical - Evidence for change
  - Physical change – strong signals (Hobday and Pecl, 2014)
    - East Australia current
  - Biological range changes – weak inference (Robinson et al 2015a)
- Future
  - Physical – strong
  - Biological – yes, pelagic species projected to change distribution
    - Hobday 2010
    - Hartog et al 2011
    - Dell et al 2015
    - Robinson et al 2015b

Adaptation Challenges - pelagic fisheries

1. Perceptions of the future - difficult

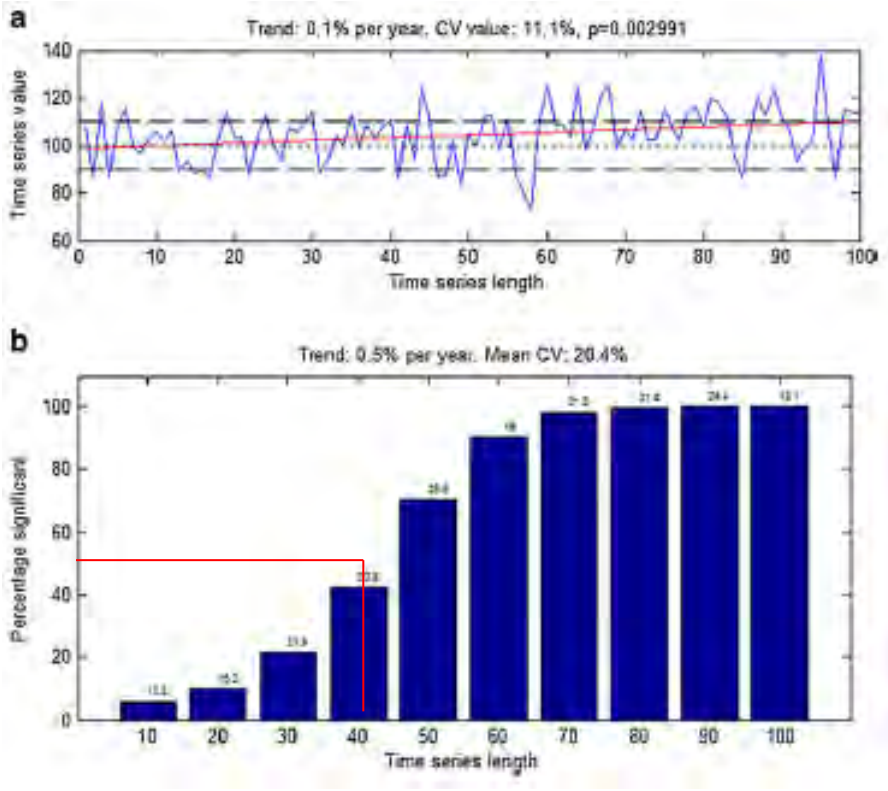
2. Detecting historical trends – hard
   - Despite wide range of data

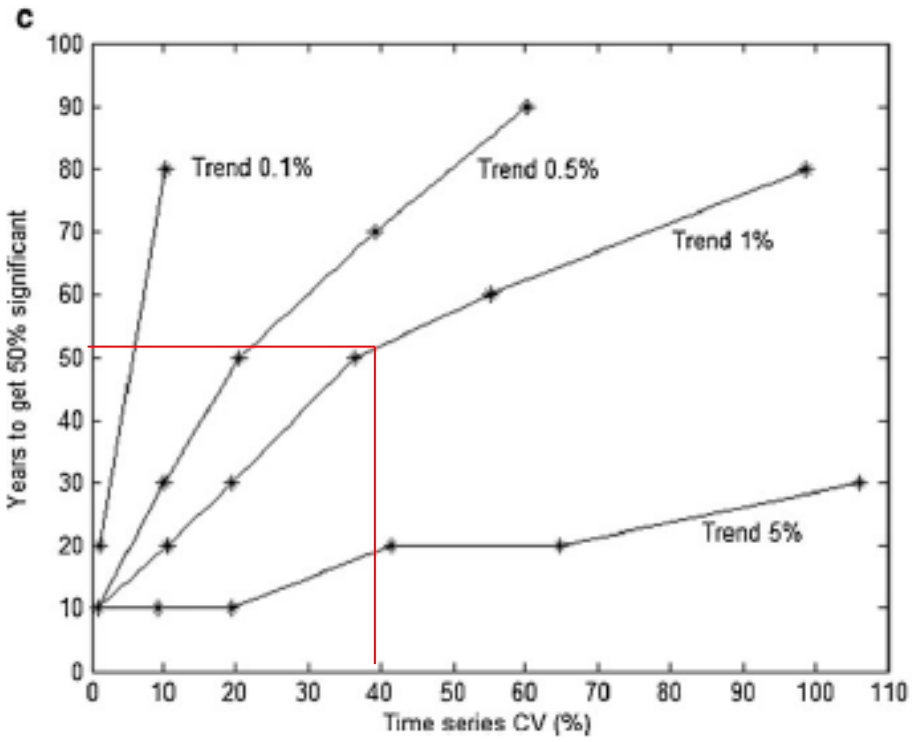
3. Fisheries have always adapted – yes, but…

4. Projecting change –
   - Climate time scales too long for many end users

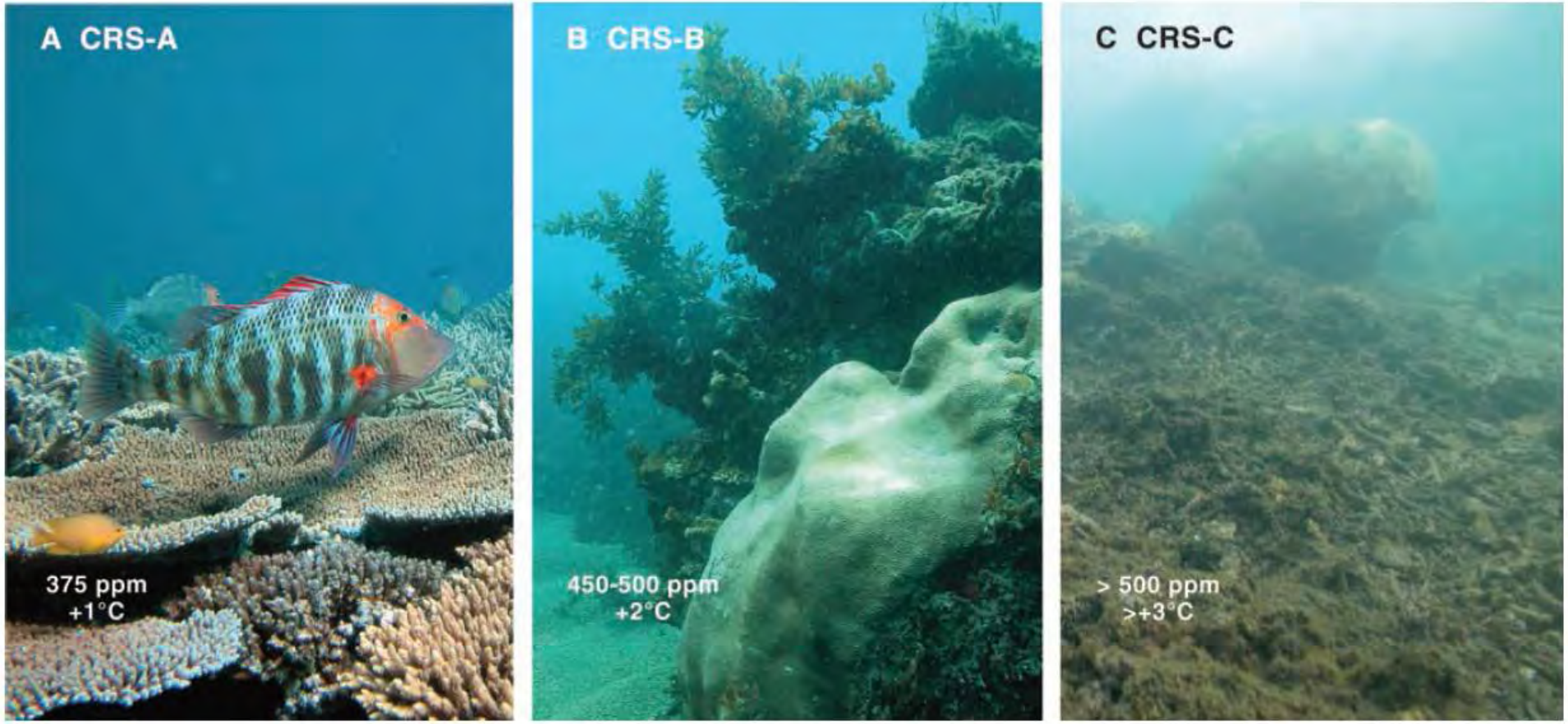
Challenge 1: Detecting historical change

(Hobday & Evans (2013) Clim. Change)





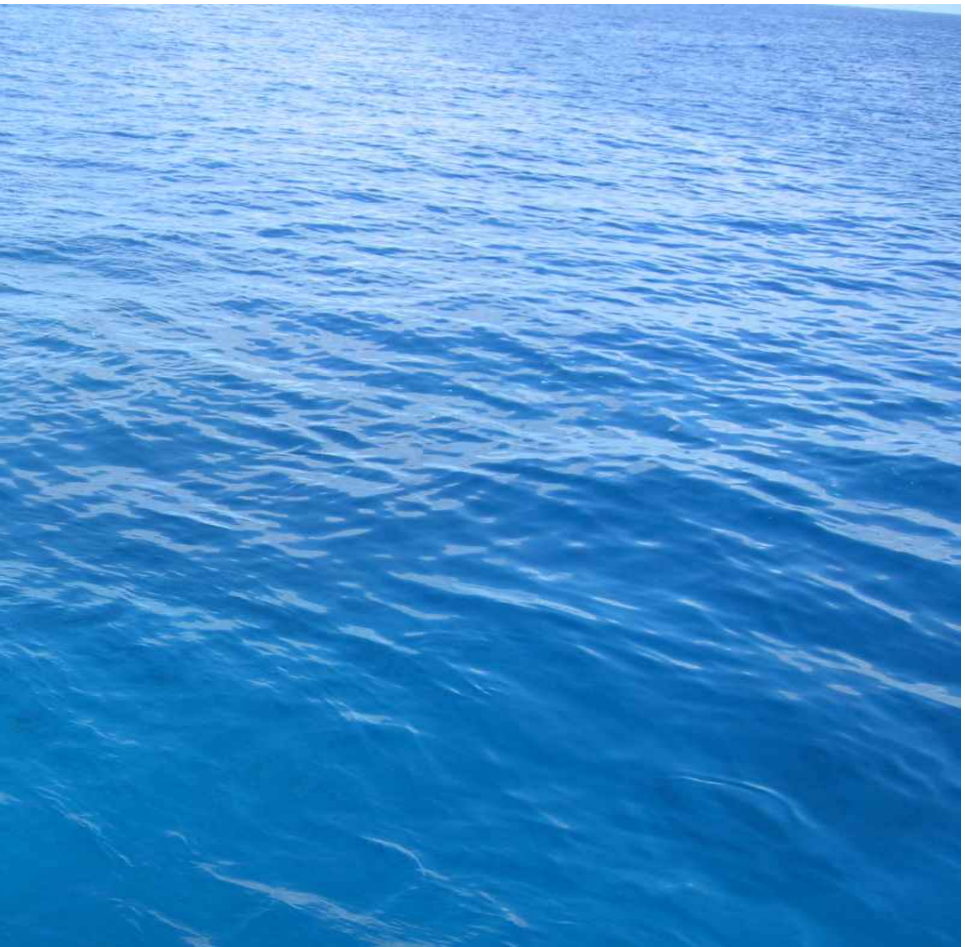
Challenge 2 – Visioning the future
Coastal ecosystems



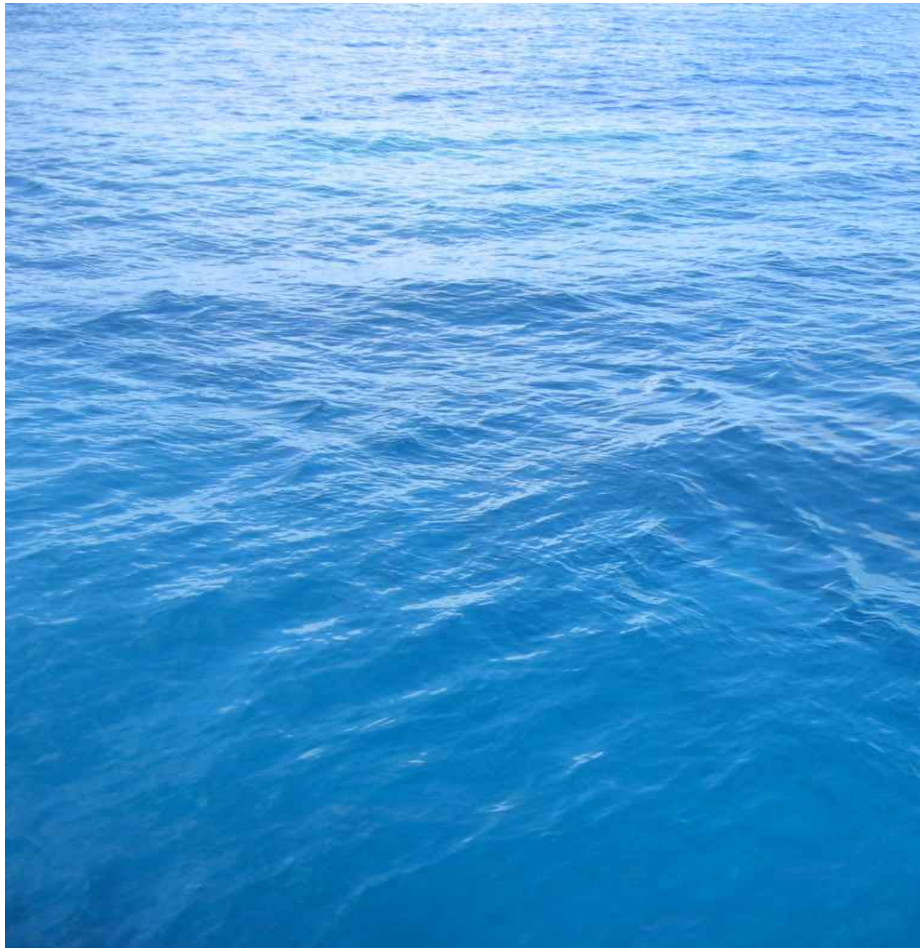
Hoegh-Guldberg et al 2007

Challenge 2 – Visioning the future
Pelagic ecosystems

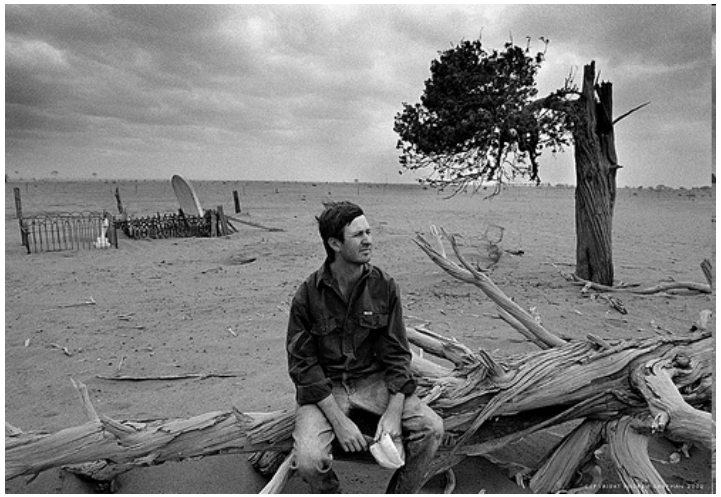
2015



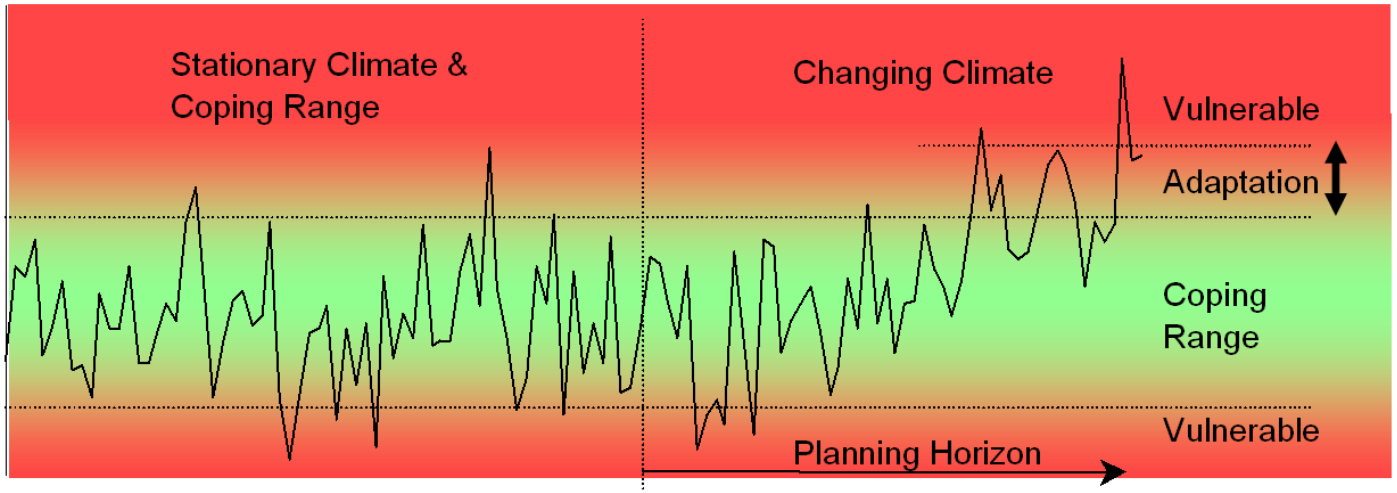
2050



Challenge 3 - Humans think they are resilient….



Fishers: “we have always adapted to changes in the past”

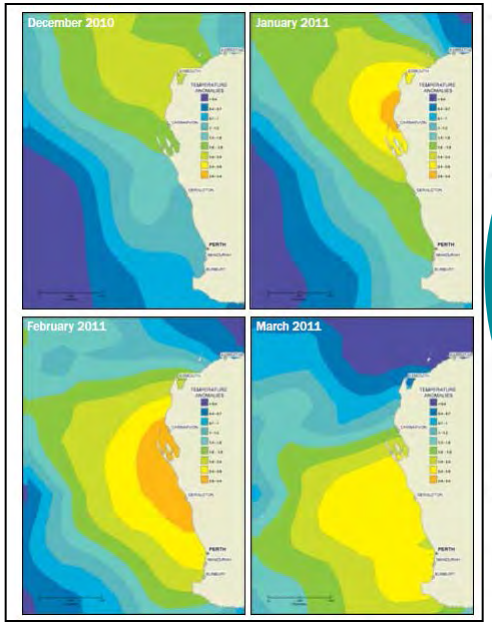


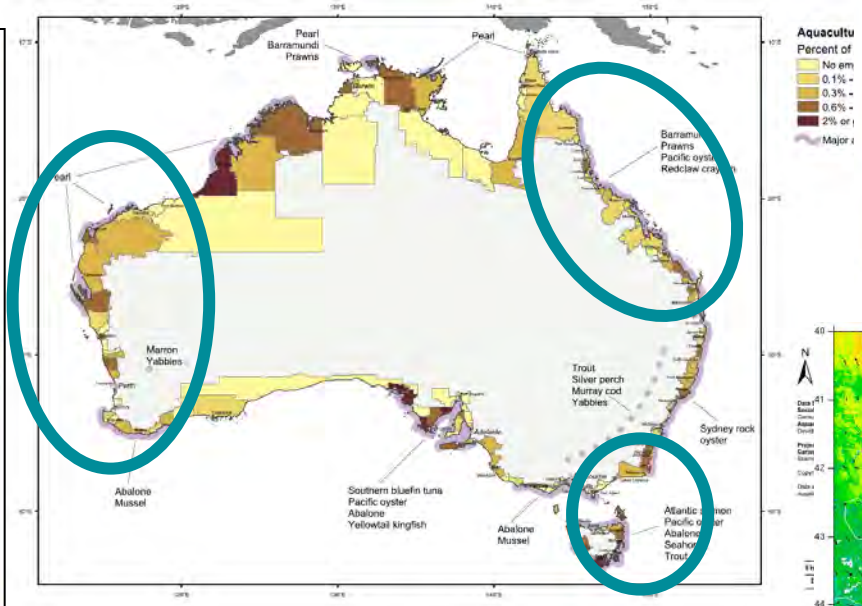
Jones & Mearns 2005

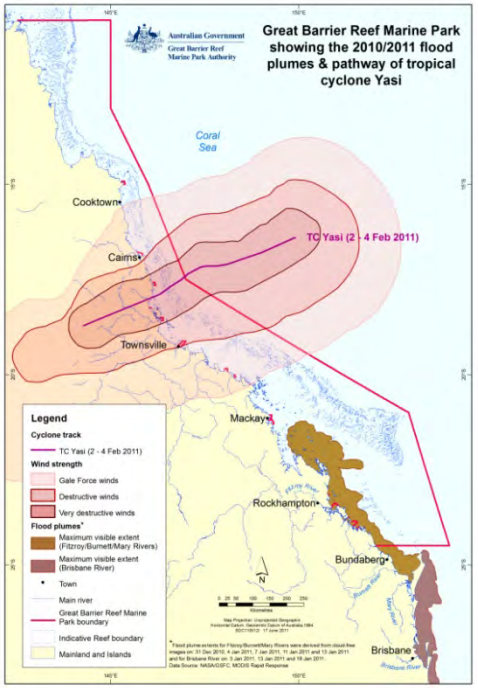
Hodgkinson et al 2014

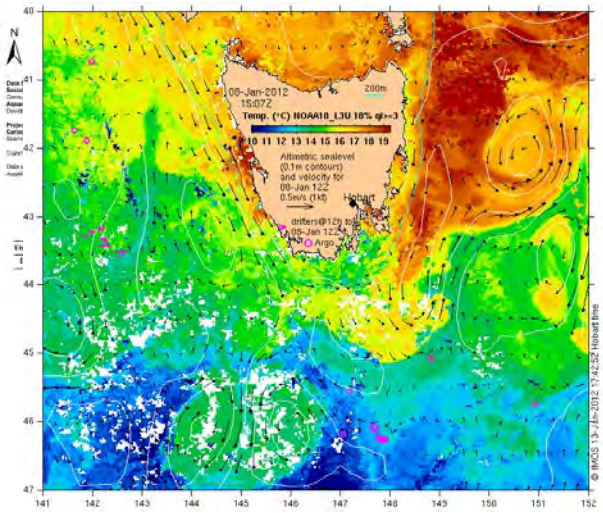
Recent marine extremes suggest otherwise

- Marine heat wave - Western Australia 2011
- Flooding and cyclone - Queensland 2011
- Abnormally warm summer - Tasmania 2012









The future will be different…

- Climate change is leading to a future where past experience is of reduced value.
- Past patterns will not be repeated: novel combinations of physics, chemistry, and biology
- Need to make decisions that are generally ok even if the details change, based on the best information available at the time (risk management)

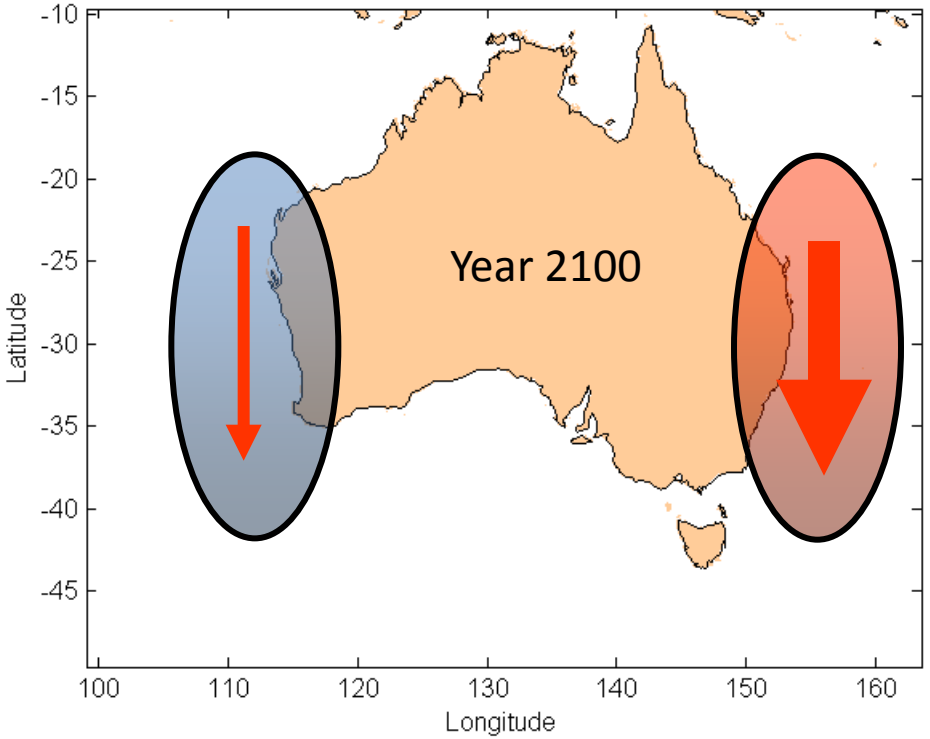
Challenge 4: Projecting changes

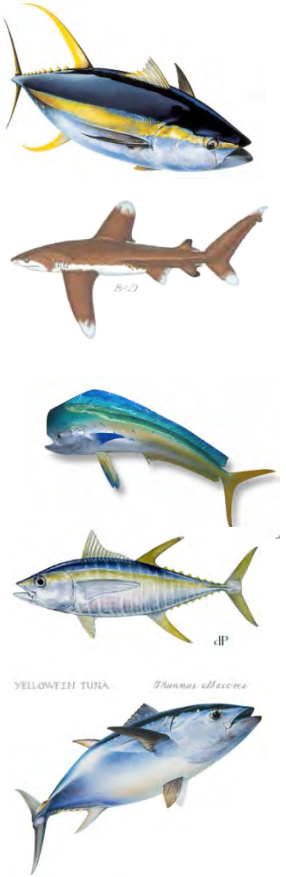
- Range changes
- Abundance
- Physiology & phenology
- Productivity of ocean

Habitat distribution – coarse resolution

(IPCC models - Hobday 2010)

11 species in Australian longline fisheries



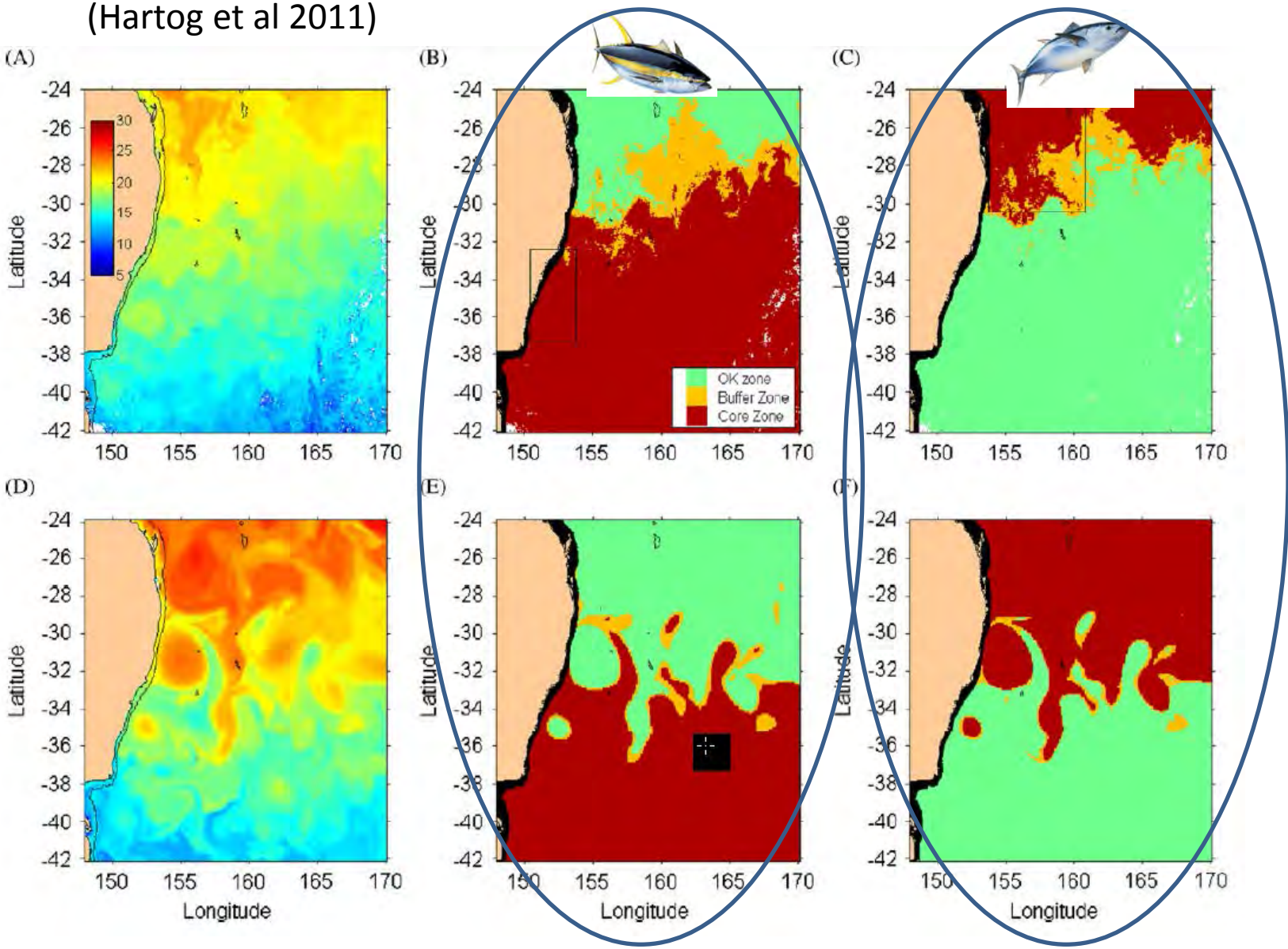


Habitat distribution – higher resolution

(Hartog et al 2011)

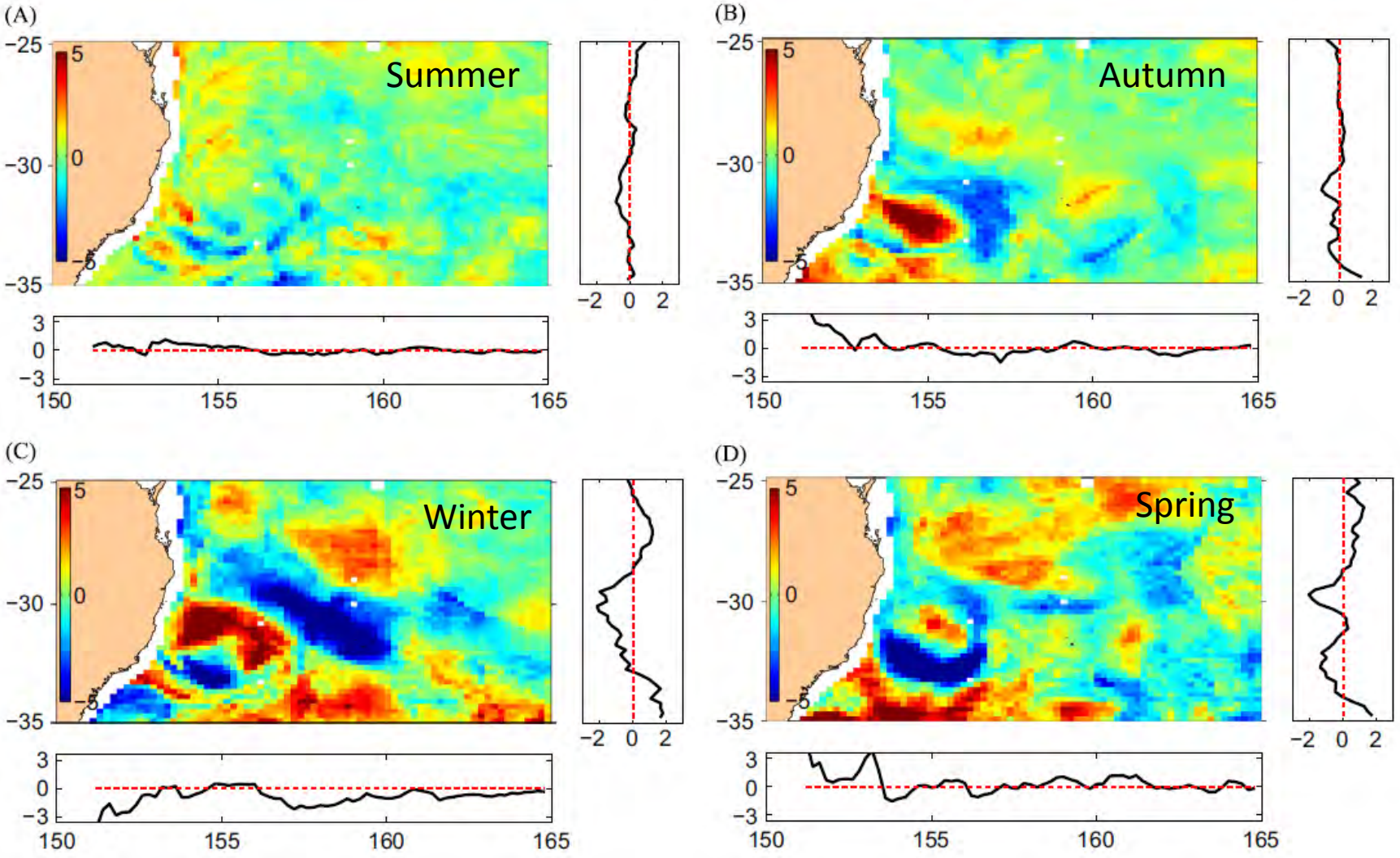
2000's

2060's



Habitat distribution - fine scale

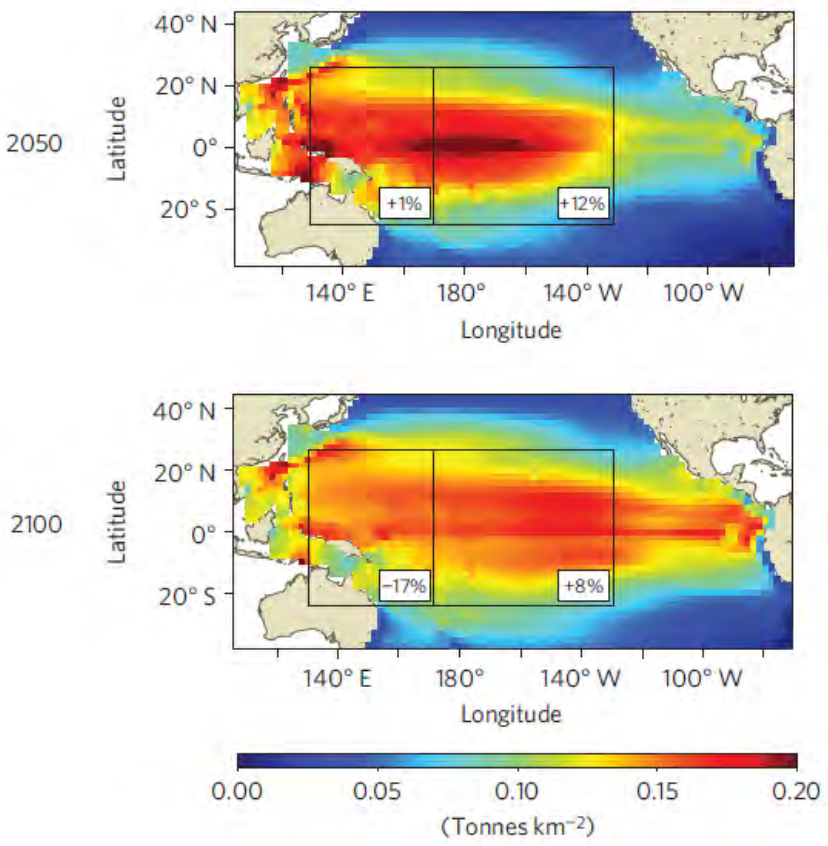
2060's vs present (Dell et al 2015)

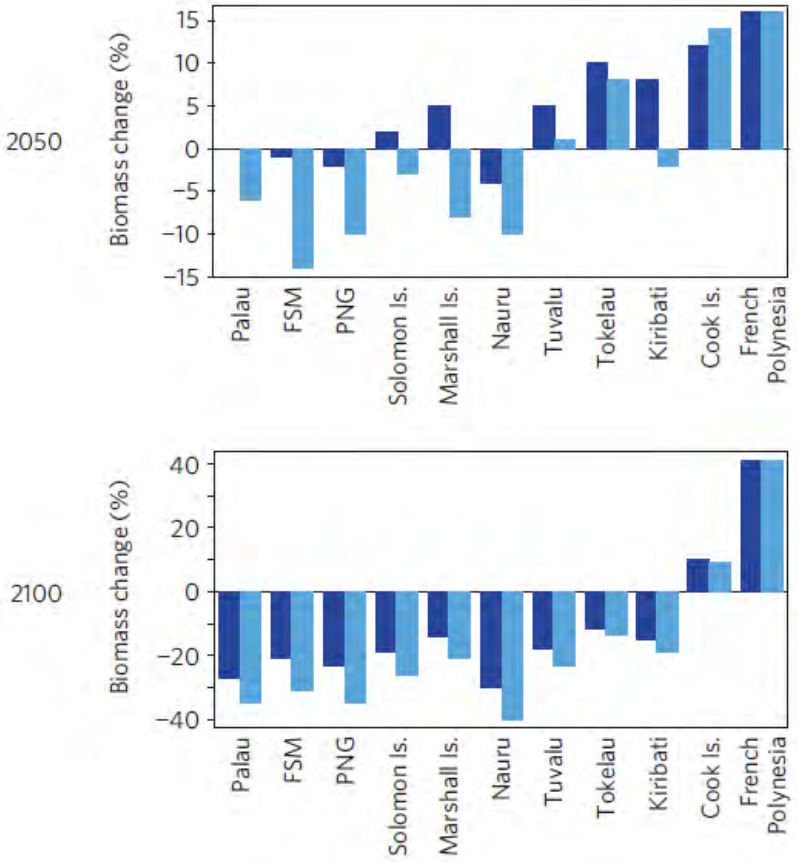


Pacific – habitat distribution

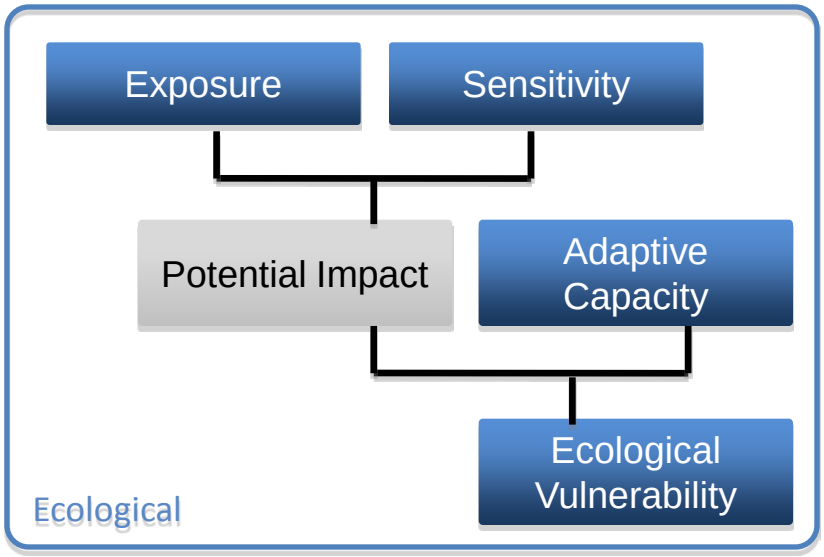
Tuna benefits move east

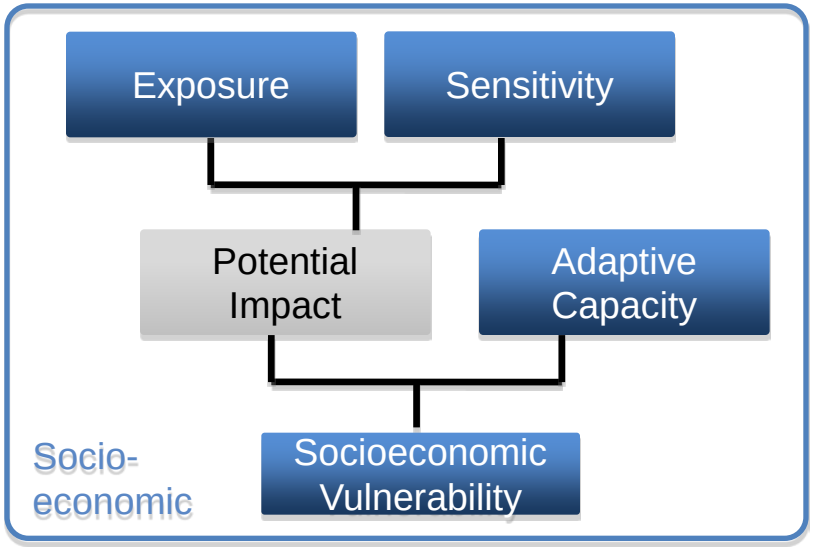
Bell et al 2013. NCC





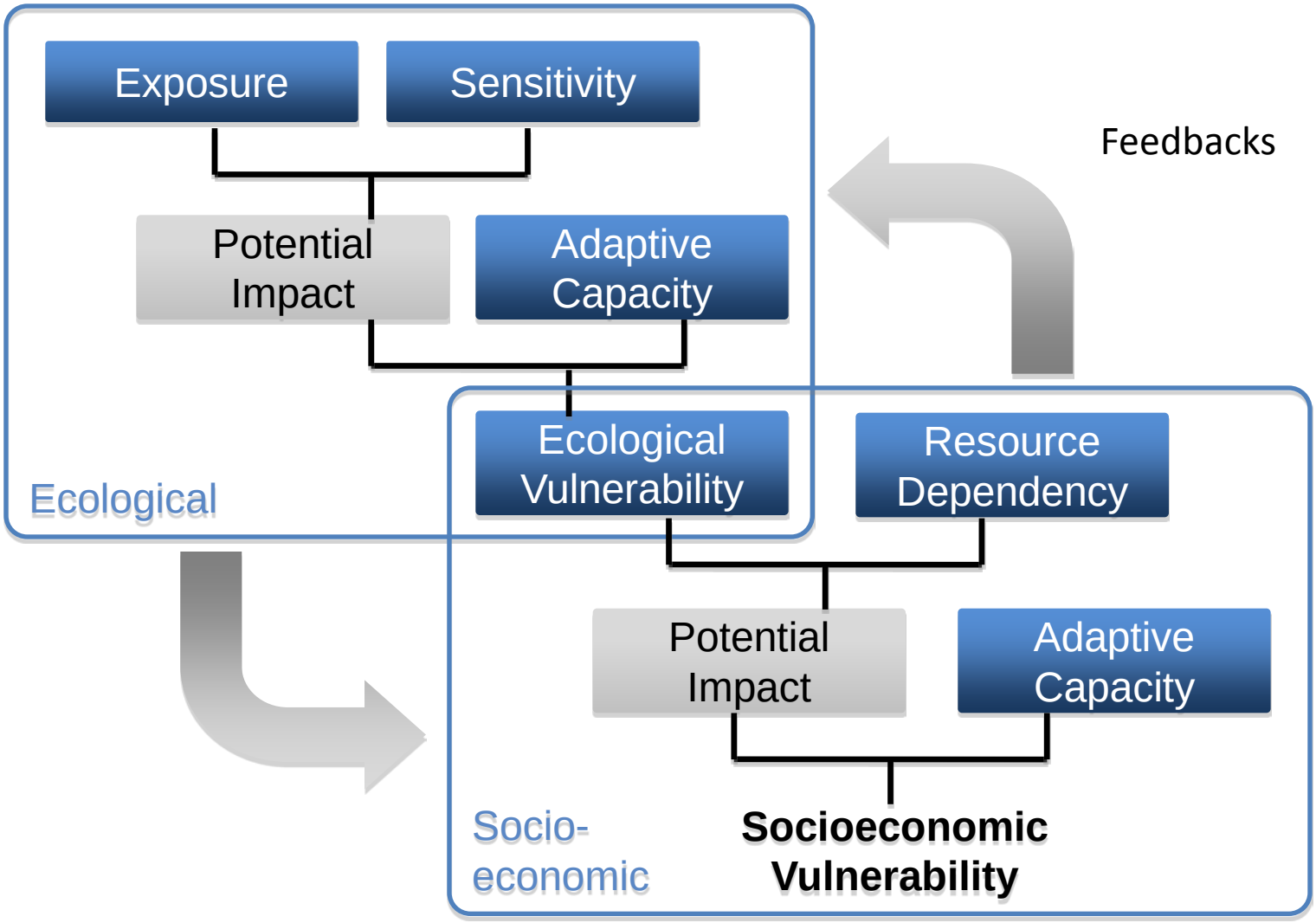
Linking ecological and social vulnerability





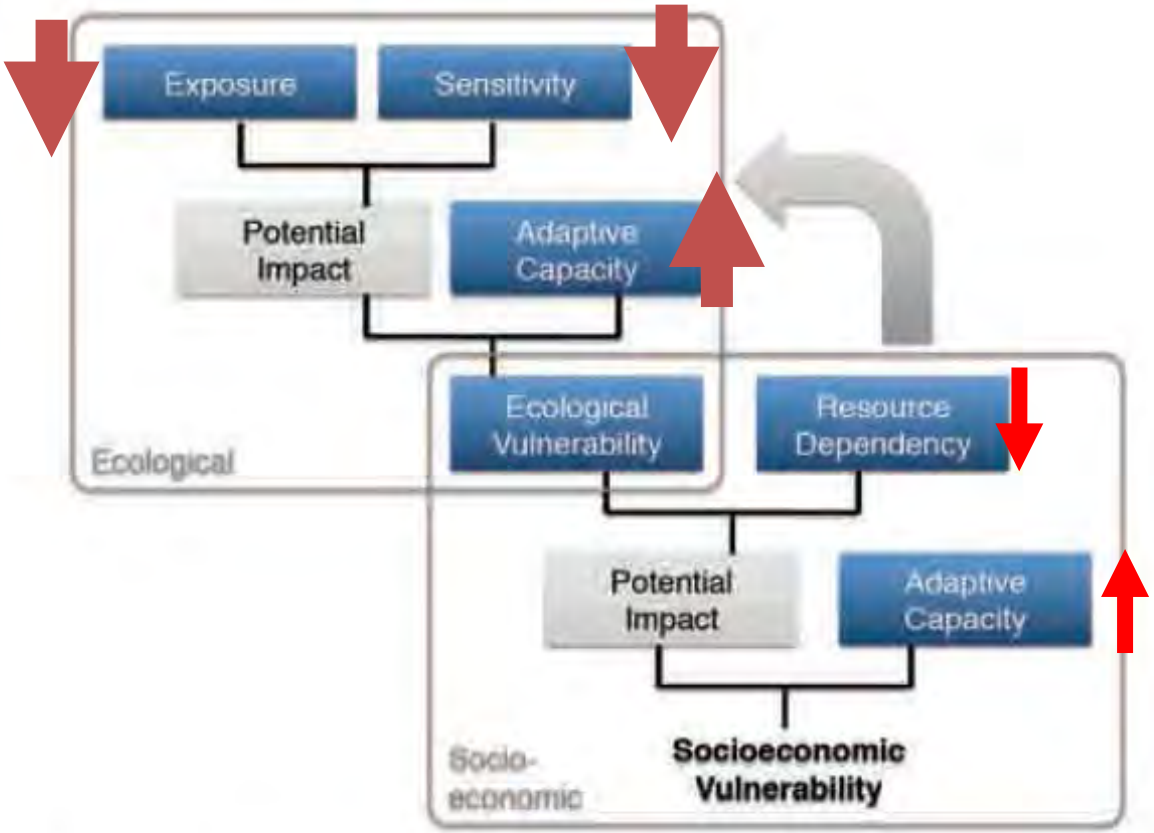
Marshall, Hobday, Marshall, 2013 (Ecosystems)

Linking ecological and social vulnerability



Marshall, Hobday, Marshall, 2013 (Ecosystems)

Generating Adaptation Options



Marshall, Hobday, Marshall, 2013 (Ecosystems)

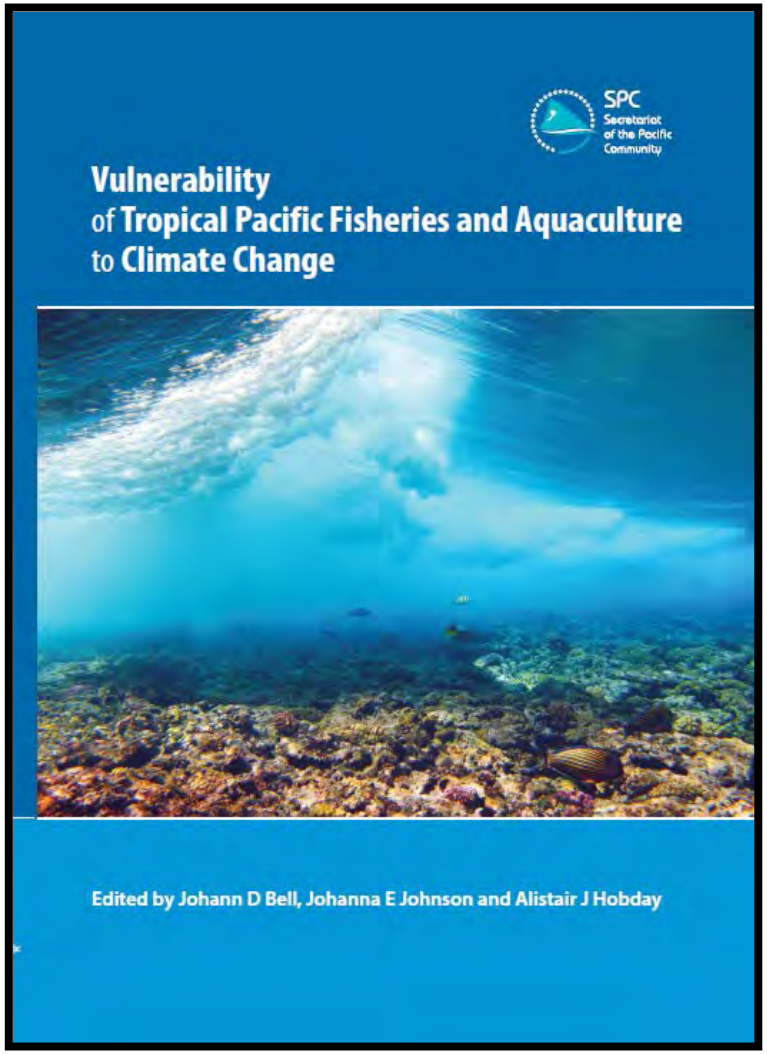
Adaptation options

- Autonomous
  - Fish – distribution, phenology

- Autonomous and directed adaptation
  - Funding agencies recognise issues
    - Targeting research (NCCARF NARP projects)
  - Scientists
    - Modelling tools that address climate change
    - Recognition of status quo as insufficient (Harvest strategies, stock assessments)
  - Fishers
    - Fishing regions and mix of species
    - Use of environmental forecasts
  - Managers
    - Changing assessment baselines (stock assessment)
    - Use of environmental forecasts
  - Policy makers
    - Jurisdictional agreements – shifting stocks

Adaptation options - plenty

- Economic development
  - Lose-Win
  - Win-Win
- Food security (fish)
  - W-W
  - L-W
- Livelihoods (employment)
  - W-W
  - L-W



How does this translate to action?

	Awareness (information)	Options and planning		Long-term actions
Pelagic fish and fisheries	Medium	yes	→	None

Translating impact to adaptation

Strategy 1 – avoid future impacts (coming decades)

1. Discover some historical impacts
2. Make some future projections
3. Develop some adaptation options
4. Implement with stakeholders (too soon?) <–> Barriers analysis

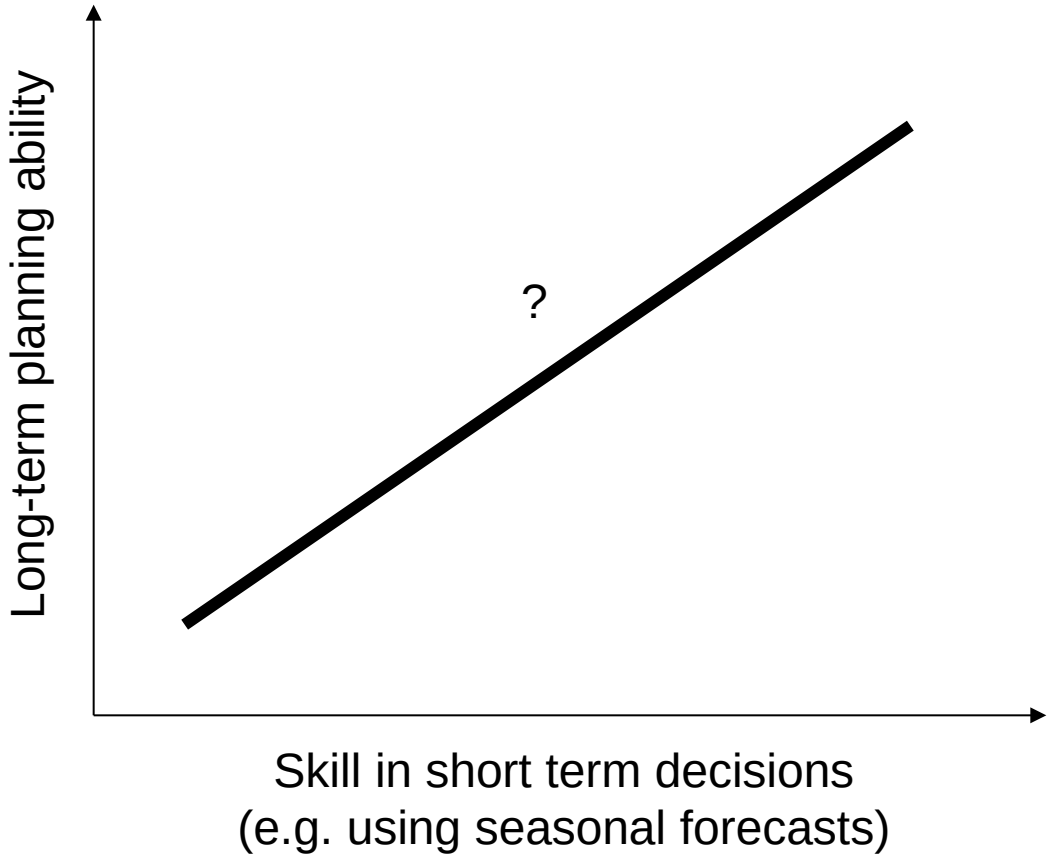
But, balance the portfolio (it's about risk management)

Strategy 2 – learn, based on current issues (CC already here)

1. Consider relevant time scales
2. Understand decision context
3. Co-develop forward looking solutions
4. Implement with stakeholders

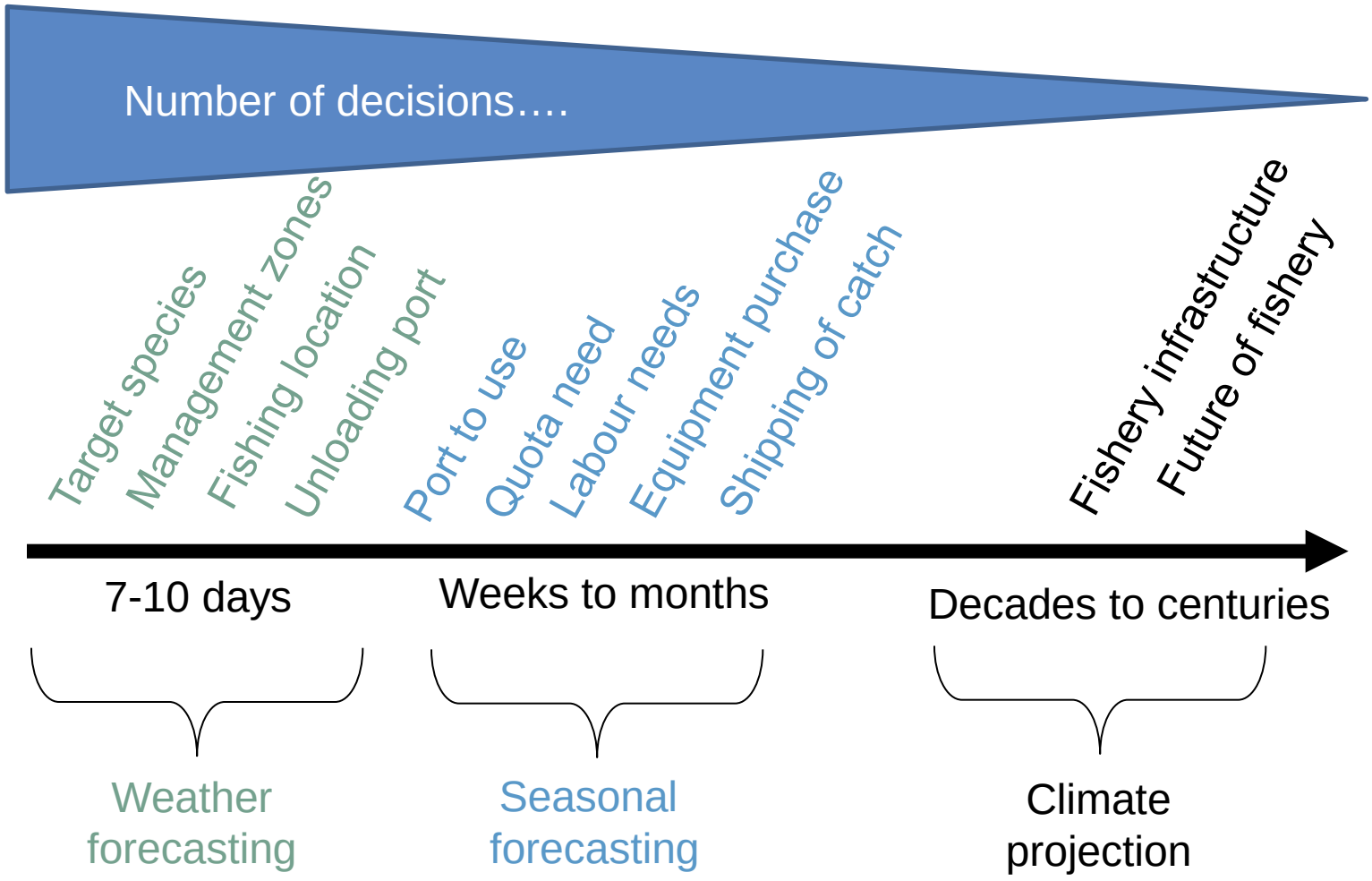
Engaging at a relevant timescale….

H_o: Thinking more about the future leads to better long term skills?



Testing planned

Relevant time scales – pelagic fisheries

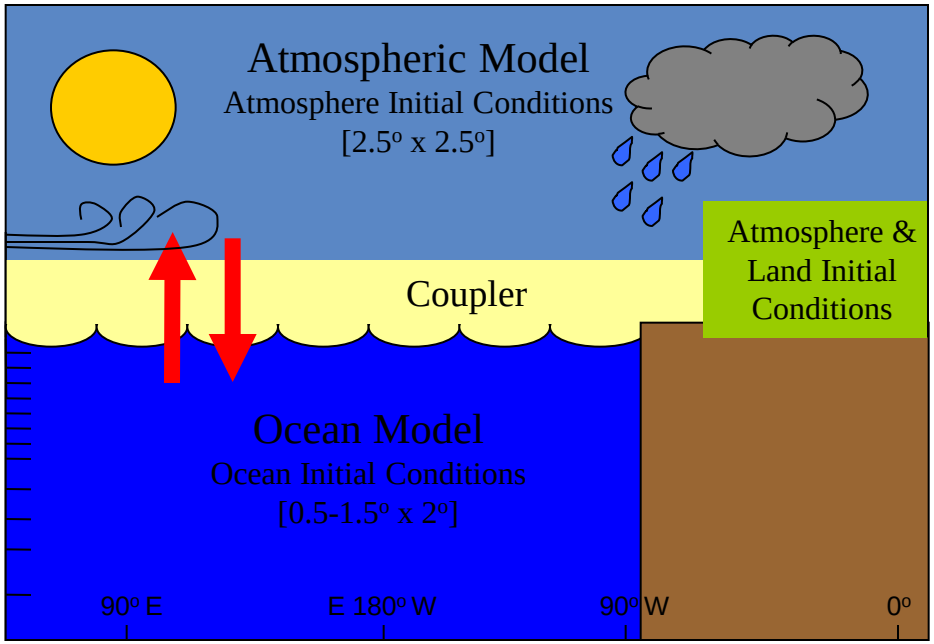


Hobday et al, in press

Seasonal forecasting model - POAMA

Predictive **O**cean **A**tmosphere **M**odel for **A**ustralia

Global dynamical coupled ensemble ocean-atmosphere and data assimilation seasonal prediction system



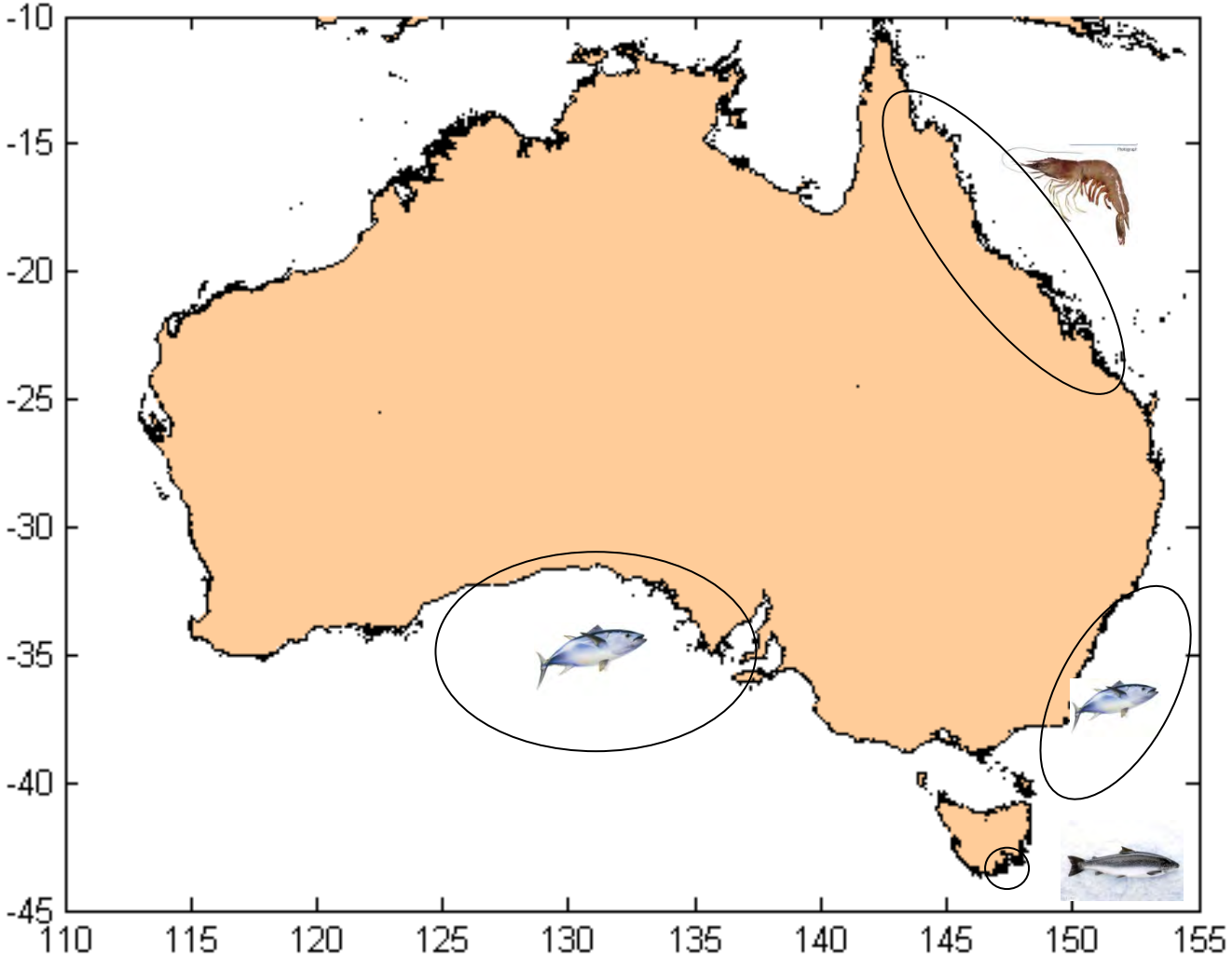
- Forecasts out to 9 months
- Weekly to seasonal multi-model predictions
- Ocean and atmosphere products available
- 33 member ensemble
- Probabilistic forecasts
- Run operationally x2 weekly

http://poama.bom.gov.au

Spillman & Alves 2009, Spillman 2011, Hudson et al 2013

Who receives seasonal forecasts?

Environment and habitat based projections



Prawns – Queensland farmers

- rainfall & air temperature
- Spillman et al. (2015)

Tuna – Eastern Australian fishery managers

- Temperature at depth
- Hobday et al (2010; 2011)

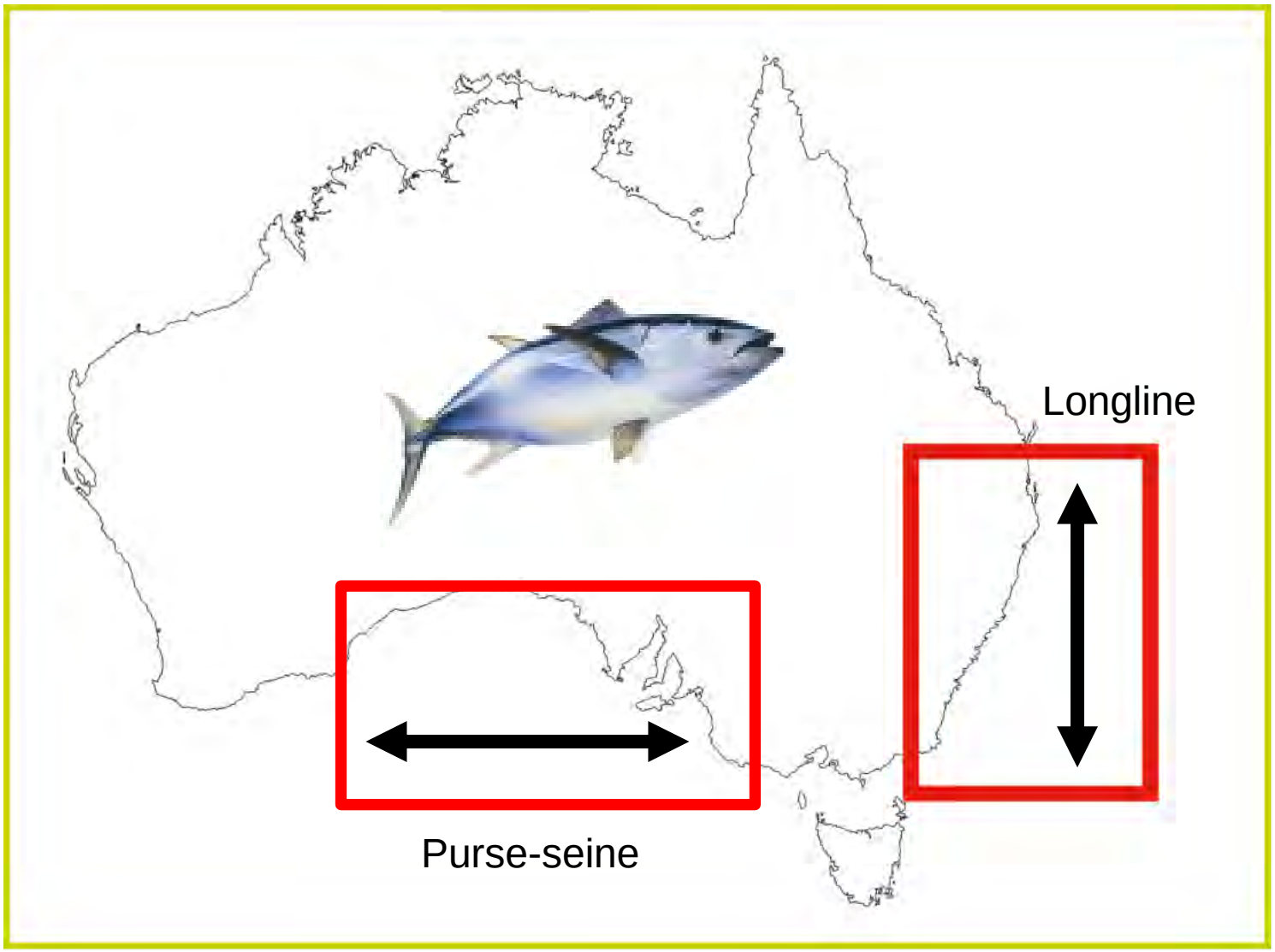
Tuna – Great Australian Bight fishers

- Sea surface temperature
- Eveson et al. in review

Salmon – Companies

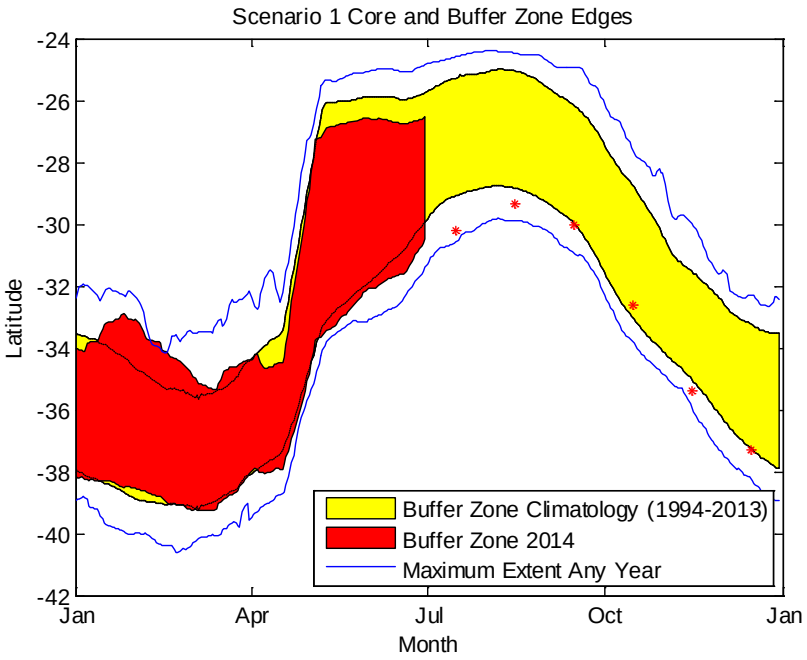
- Sea surface temperature
- Spillman & Hobday (2014)

Southern bluefin tuna - pelagic fisheries

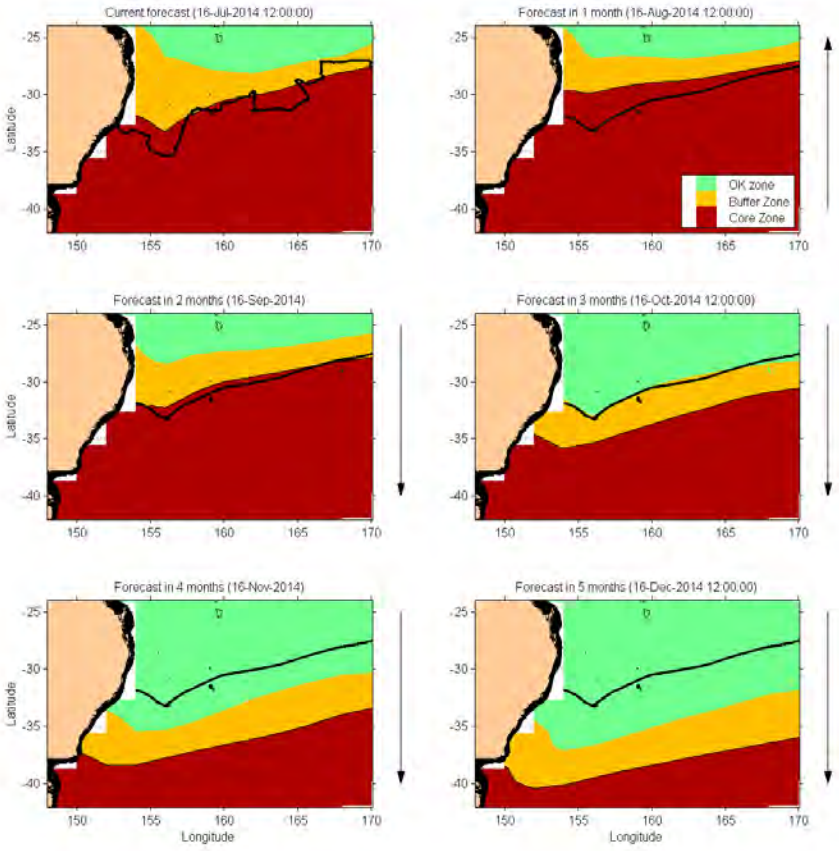


East coast - Seasonal Habitat Prediction

- Offers both managers and fishers the potential to plan for upcoming spatial restrictions, and strategically modify their fishing activities.



Hobday et al 2011



Great Australia Bight – economic efficiency

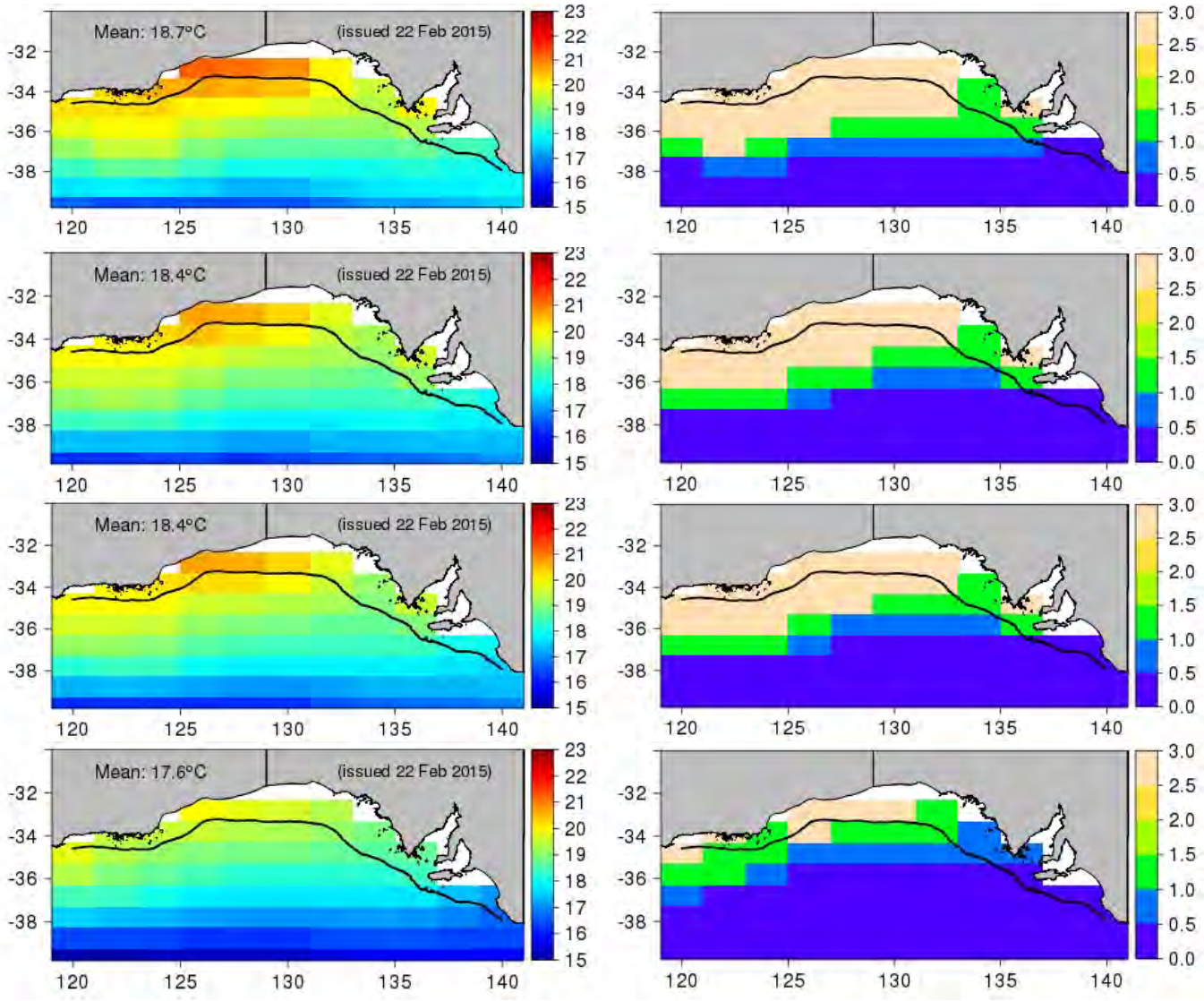
Issued 22 Feb 2015

Fortnight 1:
22 Feb – 7 Mar

Fortnight 2:
8 Mar – 21 Mar

Month 1:
March

Month 2:
April



Website

Delivery of information – targeted

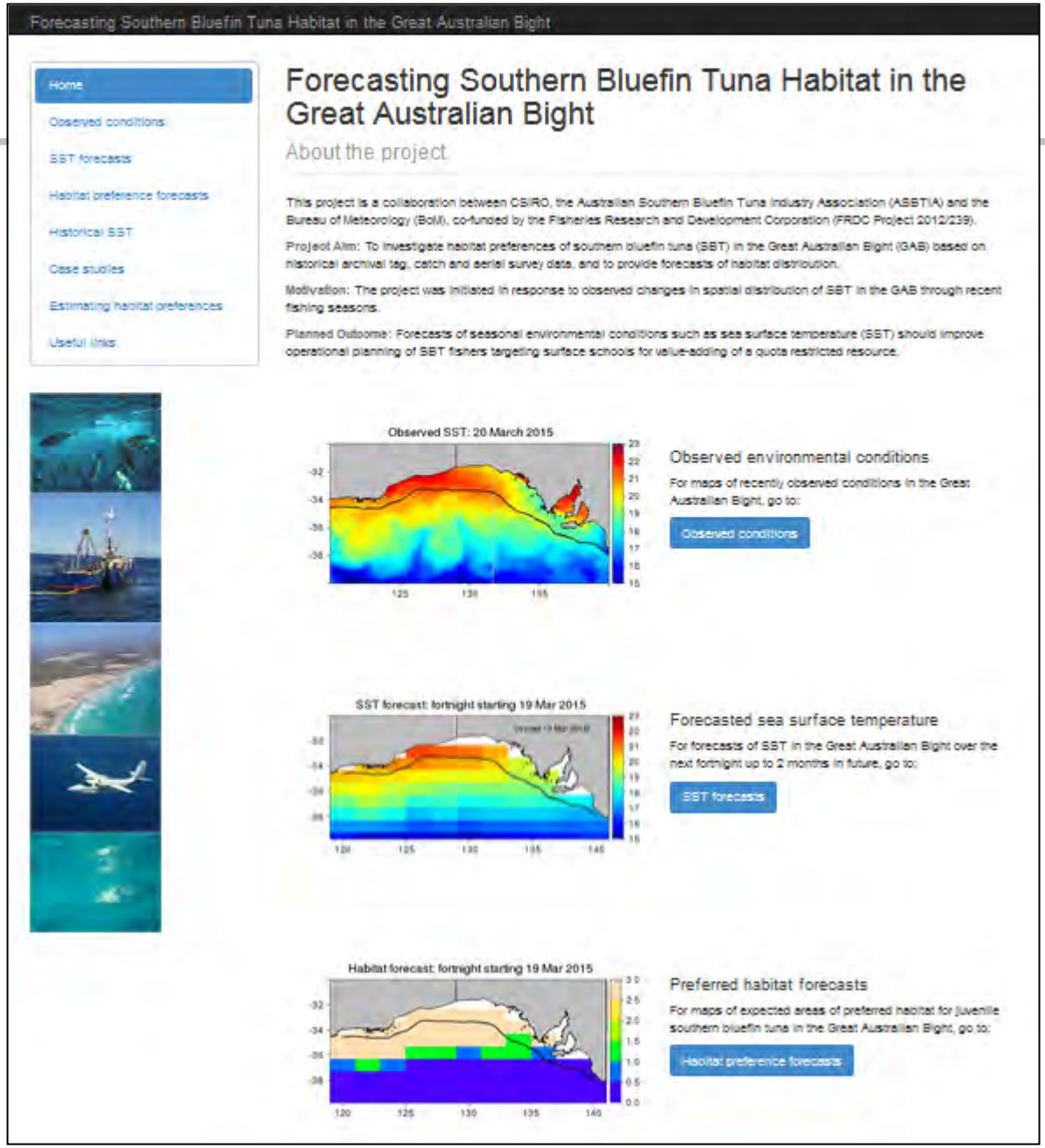
www.cmar.csiro.au/gab-forecasts

Adaptation?

In the first year
10 major fishing companies
- All used website

8 used in decision-making
- 6 made different decision
- 2 made “do nothing different”

- (when and where to fish)
- (economic benefits)



What constrained that response and what should we learn about directions to work towards to enhance adaptive capacity?

- Appropriate time scales – seasonal forecasting
  - Adaptation to variability (<10 years)
  - Does “teach” future decision making (probalistic)

- Identify opportunities
  - e.g. fishing opportunities
    - Single by single species
  - But…is opportunity a “message” or a driver?

Lyth et al 2015

Drivers for adaptation

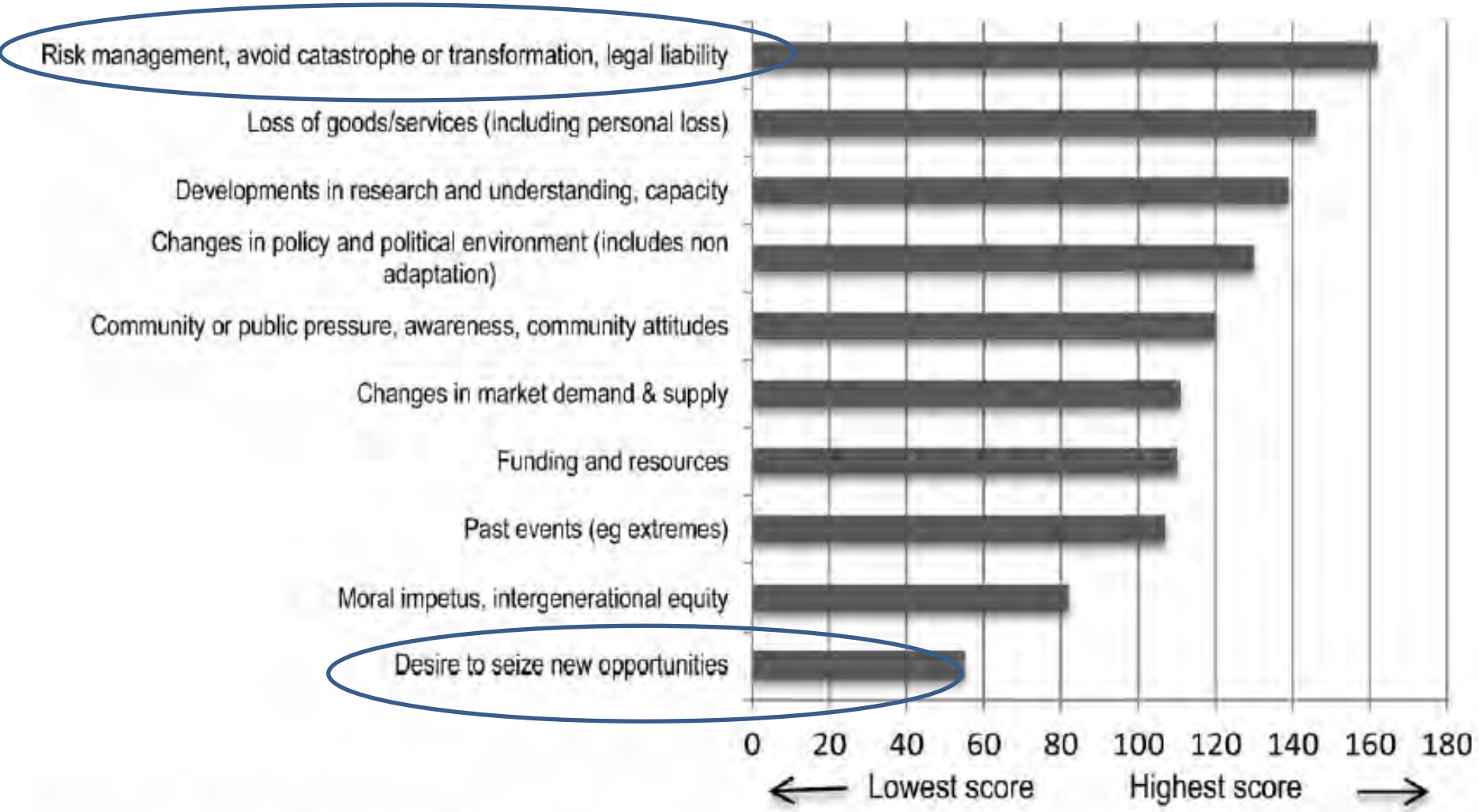


Figure 3. Top 10 drivers of climate change adaptation interest and activity as ranked by stakeholder workshop participants.

Summary

- Seafood adaptation action in Australia

	Awareness (information)	Options and planning	Short-term actions	Long-term actions
Coastal fisheries – south-east	High	Moderate	Moderate	None
Pelagic fisheries	Medium	Low-moderate	Low	None
Aquaculture	Medium	Moderate	Moderate	None
Coastal fisheries – west coast	Medium	Low-moderate	Low	None
Coastal fisheries - Northern Australia	Low	Low	Low	None

CLIOTOP 3rd Symposium

(Climate Impacts On Top Ocean Predators)

- Abstracts - close March 31

- Climate and pelagic species
  - Special issue – just out
    - 26 papers from 2nd symposium (2013)