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# Stop, Change or Move?

## Practical adaptation of commercial fishers to spatial changes in fish abundance due to extreme weather events

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# Climate change

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- Climate change is happening...
  - Changes to marine habitats
  - Changes for marine species

# Climate change in Australia

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# … In Tropical Australia

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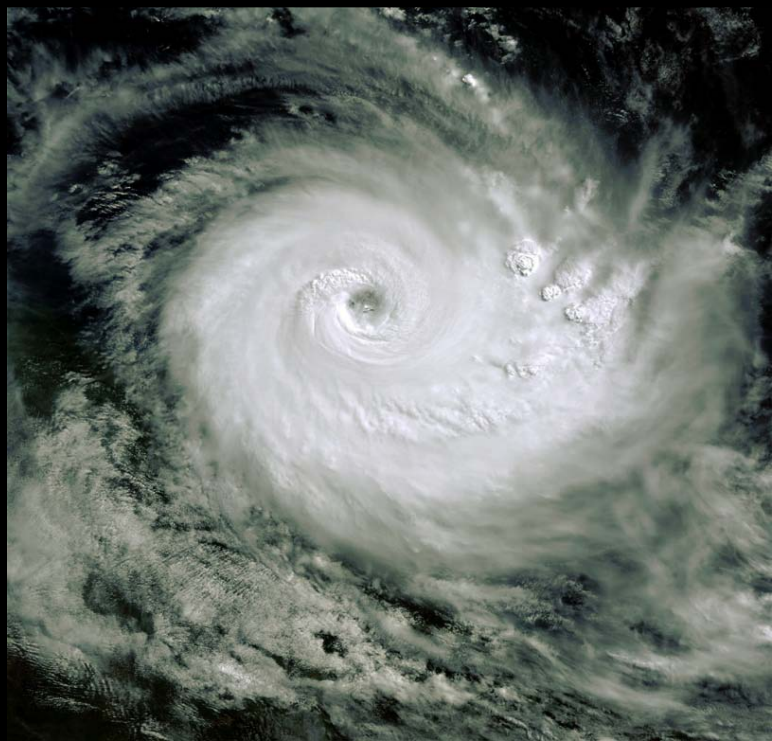
Climate Change predictions:

- Increase sea surface temperature;
- Ocean acidification;
- Changed rainfall patterns; and
- Cyclones will increasingly be intense

(Nicholls et al. 1998; Johnson and Marshall 2007; Hobday et al. 2008)



# Cyclones on the GBR

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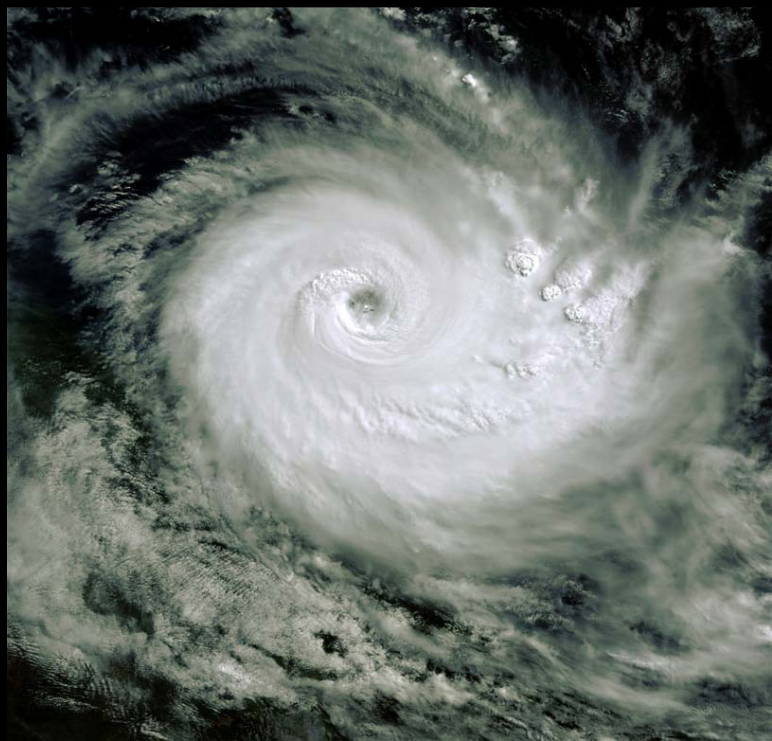
3 category 5 cyclones in past 5 years:

1) TC Larry, 2006;

2) TC Hamish, 2009;

3) TC Yasi, 2011



# Cyclones on the GBR

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3 category 5 cyclones in past 5 years:

1) TC Larry, 2006;

2) TC Hamish, 2009;

3) TC Yasi, 2011

Effects:

- Damage to habitat
- Increased freshwater influx
- Decline in abundance of some fish (at least temporarily)

(Halford et al. 2004; Munday et al. 2007)

So what?

# So what? Who cares?

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## Fishers!

## Scientists...

- Cyclones = example of reduction in fish abundance
- Potential to explore adaptation to contractions of distribution
  - Range shifts...
- What are fishers' options to ADAPT
  1. Stop fishing
  2. Change species
  3. Change fisheries
  4. Move areas
- Good in theory...
- Practical limitations

# Limitations to adapting...

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| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 1) Stop fishing | | | |
| 2) Change species | | | |
| 3) Change fisheries | | | |
| 4) Move | | | |

# Case study - TC Hamish


- Category 5 (intense)
- Tracked along southern GBR
- Affected Reef Line Fishery
  - 70% of coral trout catch
- Call for help from fishers…
- Others explored fish reaction
  - Significant reduction in catchability of coral trout
- I explored FISHER reaction
  - Surveyed 18 fishers in area
  - 3, 6 and 12 months after

# The Reef Line Fishery

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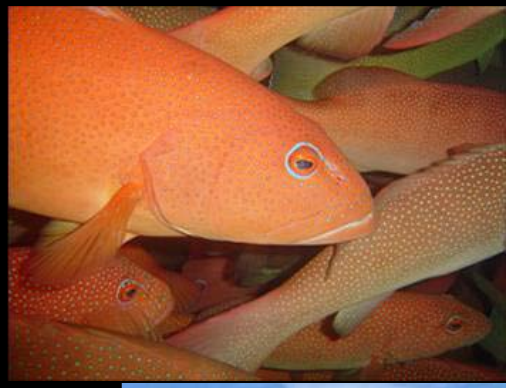
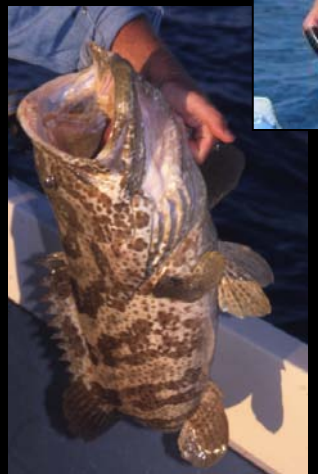
- Operates along length of Great Barrier Reef
- Targets reef fish
  - Coral trout → Main species – live to Hong Kong
  - Red Throat Emperor
  - 'Other species' (cods, emperors and tropical snappers)
- Quota managed
- Single hook and line
- Single small vessel vs larger mother boat + dories
- ~250 active licences. Most in southern GBR





# Fisher reactions...

| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 1) Stop fishing | ✗ | ✓ | ✓ |

40% immediately stopped

- Reduce costs
- Allow recovery
- Correlated with vessel size
  - – small vessels able to stop for longer
  - – large vessel needed income for themselves and crew

80% returned within 3 months

All returned with 6 months (EXCEPT 1 = out of business)

- – need for income; high dependency

... But catches still not back to normal

# Fisher reactions...

| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 2) Change species | ✗ | ✓ | ✓ |

Filleting restrictions

- lifted for 12 months
- Adaptive management

22% sold RTE / OS within 6 months

Coral trout remains primary (>70% income) for ALL

- Higher value
- Markets unavailable for fillet product
  - Often of poor quality (loss of skills)

# Fisher reactions...

| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 3) Change fisheries | ✗ | ✓ | ? |

All surveyed fishers were specialised reef fishers

- Held other symbols
- Did not change fisheries…
  - Likely related to price
  - Available infrastructure
  - Skills
  - Confounded by sample selection?

# Fisher reactions...

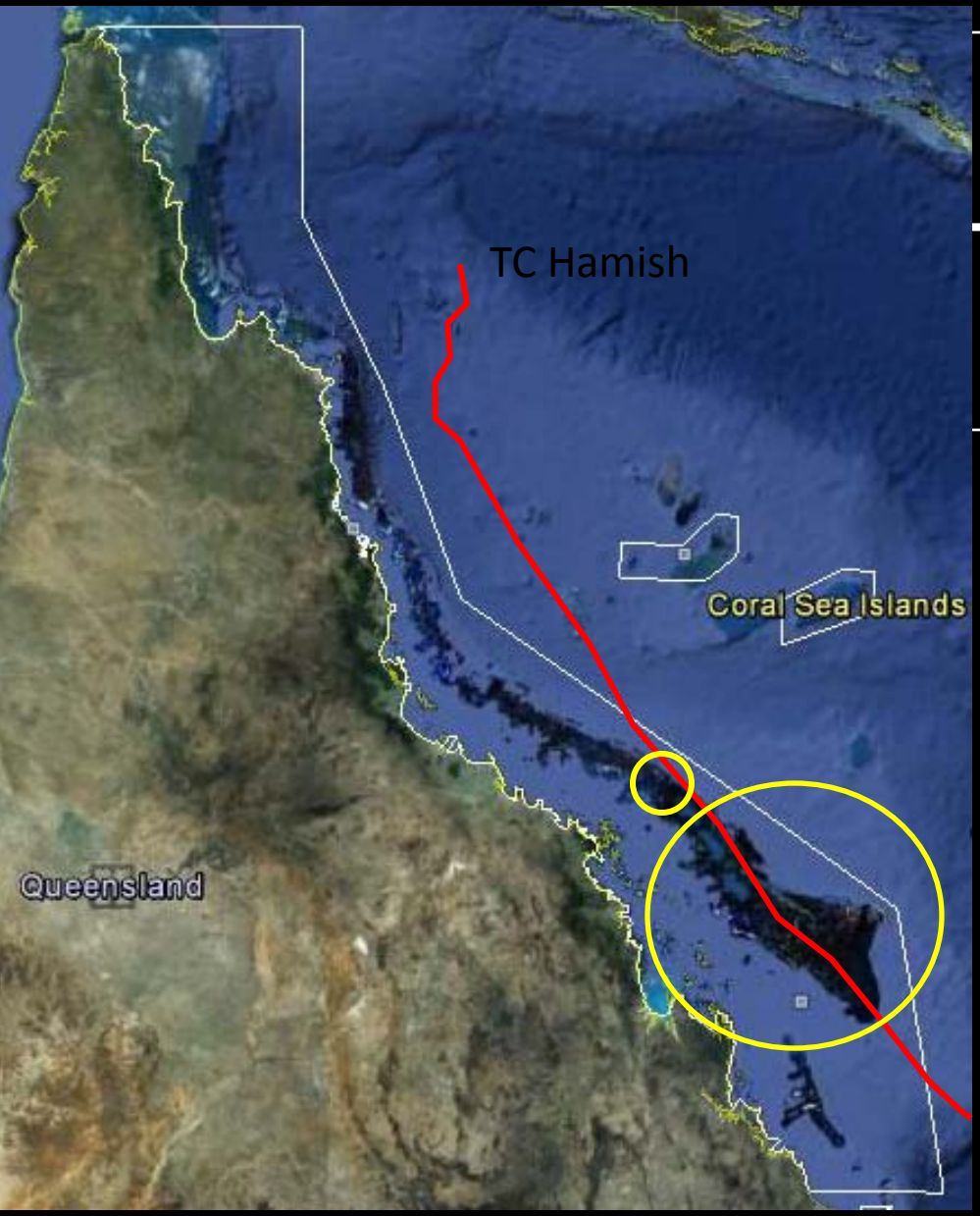
| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 4) Move | X | | |

30% moved immediately

60% moved within 3 months

- correlated with vessel size – small vessels remained
- All moved within very limited area

# Fisher reactions...




| Economic limits | Social limits |
| --- | --- |
| | |

# Fisher reactions...

| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 4) Move | ✗ | ✓ | ✓ |

30% moved immediately

60% moved within 3 months

- correlated with vessel size – small vessels remained
- All moved within very limited area
- Attachment to place
  - markets
  - fuel costs
  - family

# Fisher reactions...

| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 4) Move | ✗ | ✓ | ✓ |

30% moved immediately

60% moved within 3 months

- correlated with vessel size – small vessels remained
- All moved within very limited area
  - Attachment to place
    - markets, fuel costs, family
- Rapidly fished new area down
  - 50% returned by 6 months
  - 90% returned by 12 months

... But catches still not back to normal

# Fishers reactions...

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| Limitations → Options ↓ | Governance | Economic limits | Social limits |
|---|---|---|---|
| 1) Stop fishing | ✗ | ✓ | ✓ |
| 2) Change species | ✗ | ✓ | ✓ |
| 3) Change fisheries | ✗ | ✓ | ? |
| 4) Move | ✗ | ✓ | ✓ |

Need a good understanding of human dimensions

Each case likely to be different!

# Conclusions

- Social and economic limits to adaptation abound
- This industry did not adapt well
  - STILL ongoing issues and cries for help...
- Messages for industry:
  - Diversify species, fisheries and markets
  - Create financial buffer
- Messages for managers:
  - Allow adaptive management
  - Encourage diversification
- Messages for researchers:
  - Understand the human dimensions

# Thank you


- Funders: GBRMPA and MTSRF
- Co-authors: Ann Penny, Stephen Sutton, Andrew Tobin, Nadine Marshall
- The surveyed fishers for telling us their stories over the year!


*"It is not the strongest of species that survives,*
*nor the most intelligent,*
*but the most responsive to change"*
Charles Darwin


Australian Government
Great Barrier Reef Marine Park Authority

Australian Government
Department of the Environment, Water, Heritage and the Arts