Atlantis Course Universidad de Concepción

Day 2 - Juan Fernández Ridge Ecosystem

Javier Porobic; Beth Fulton

CSIRO Ocean & Atmosphere
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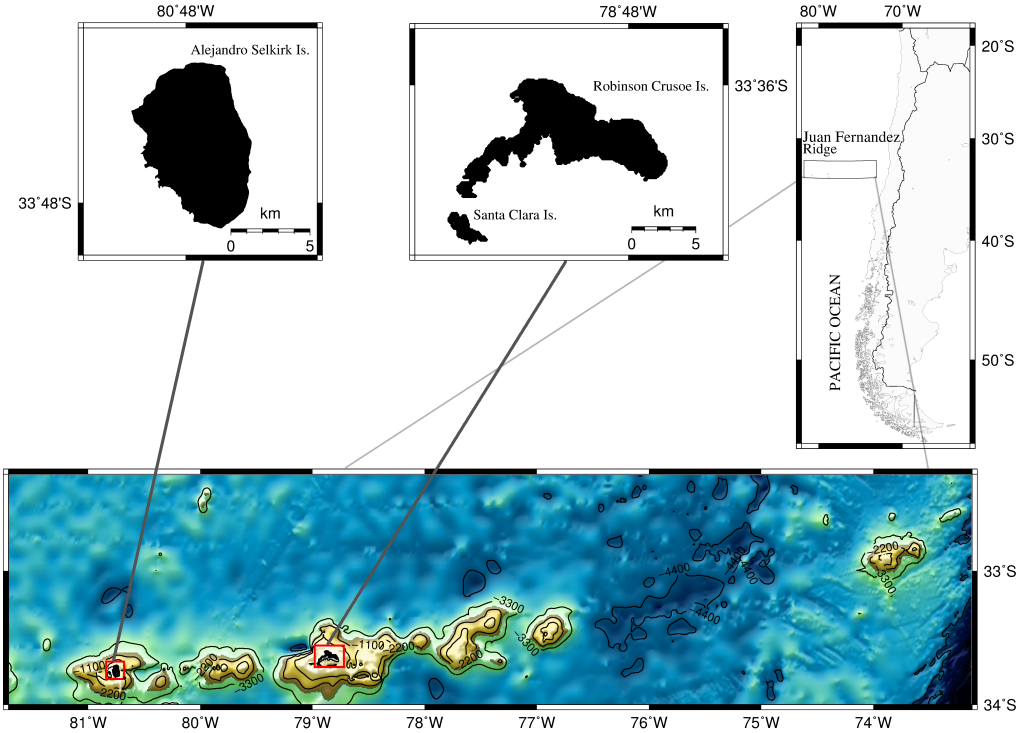
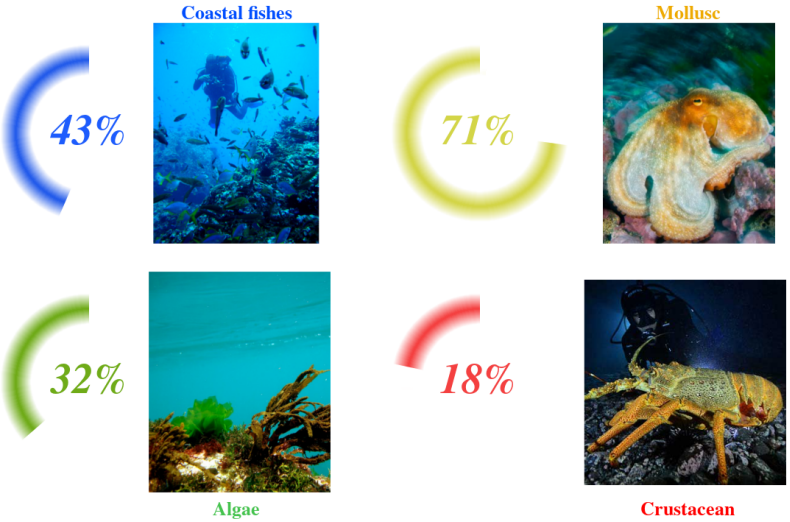
Juan Fernández Ridge Ecosystem



Juan Fernández Ridge Ecosystem

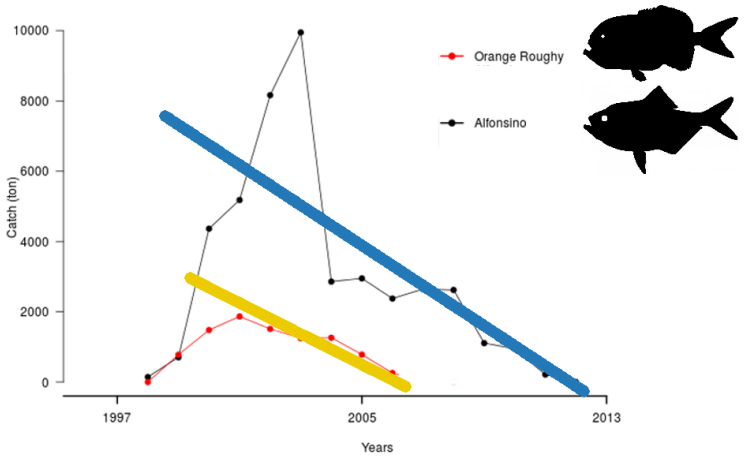
- 80% of endemism
- 60% historical extinctions
- 59% threatened or rare species
- Biosphere Reserve (1977)
- Highest Conservation Priority Chile



Economy - Fisheries

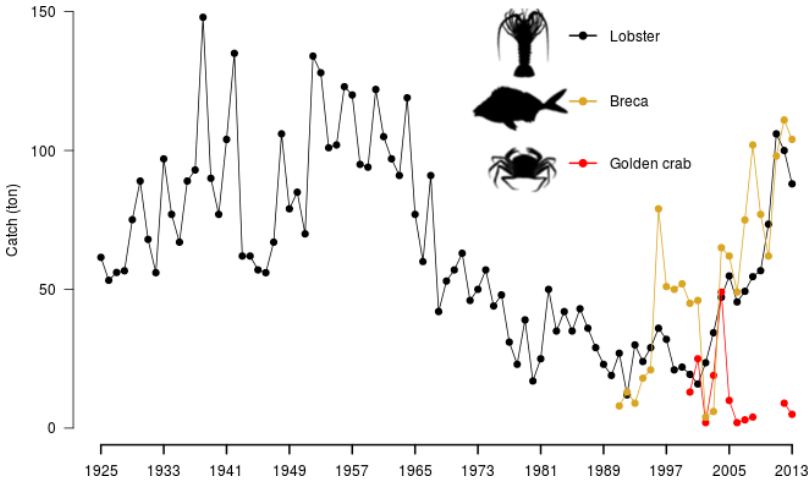
The industrial fleet

- Trawling fisheries
- Boom-and-Bust fishery
- Both currently closed
  - 2006 Orange roughy
  - 2012 Alfonsino



The artisanal fleet

- Tightly-knit fishing community
- Main economic income
  - 70% Lobster fishery
- Management
  - 3S type - Formal management
    - **S**ize - **S**ex - **S**eason
  - Internal code of conduct
  - Likely future increase in fishing effort



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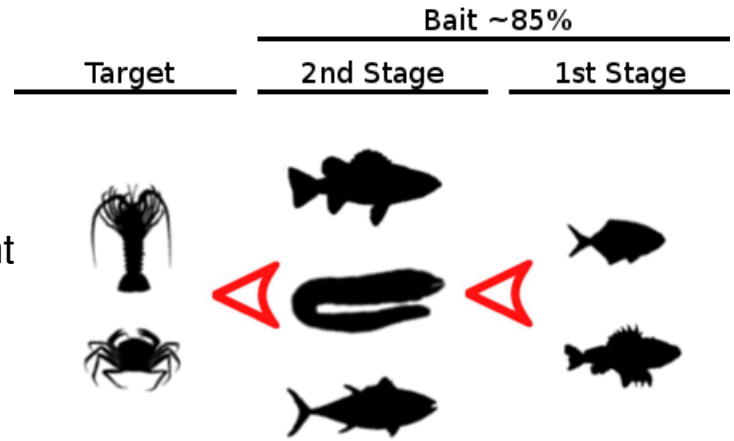
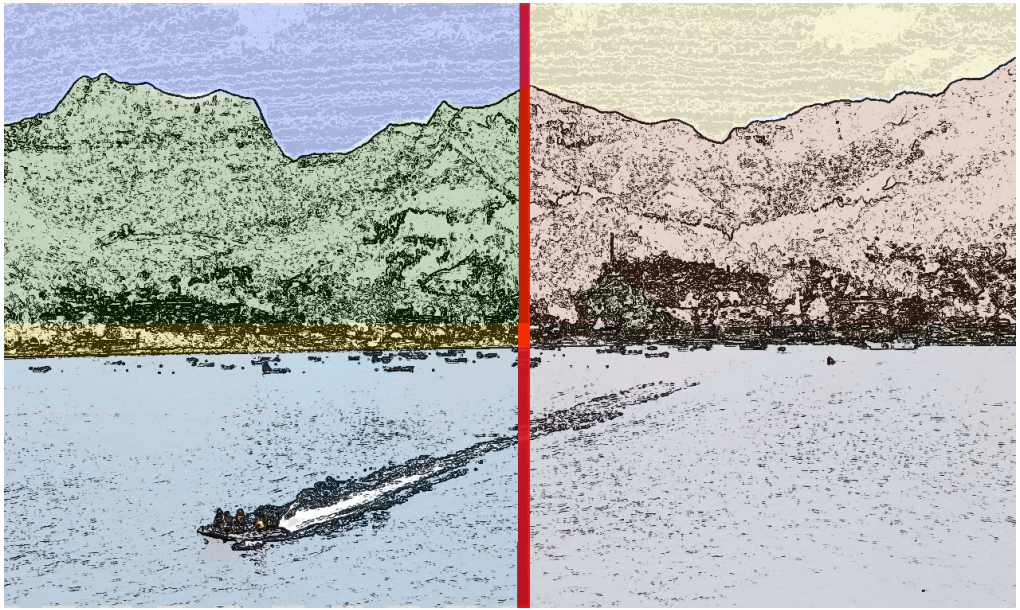
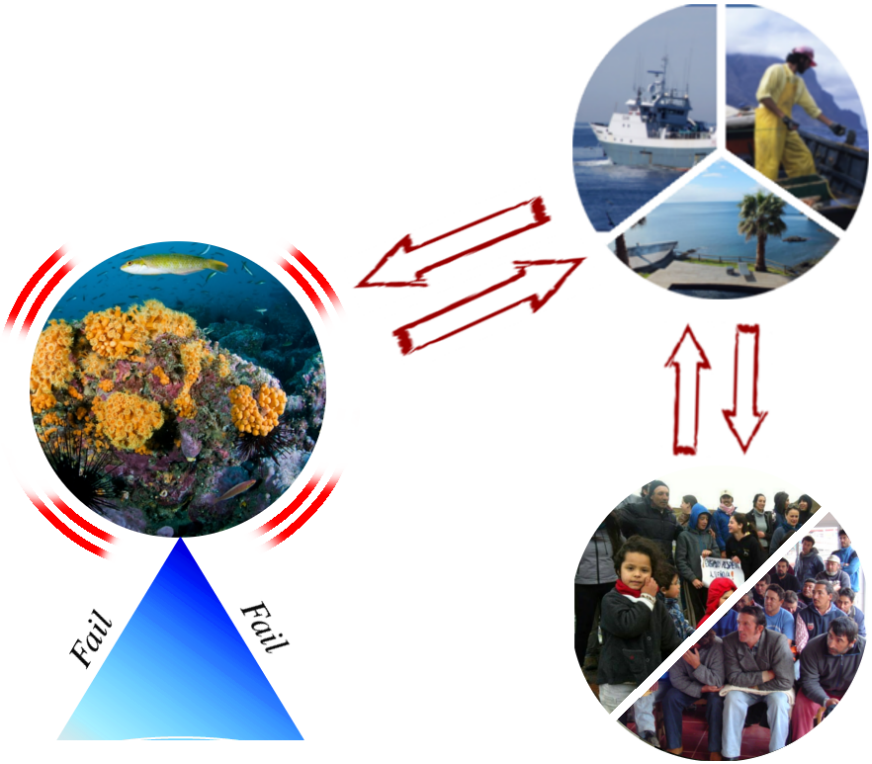


Climate Change

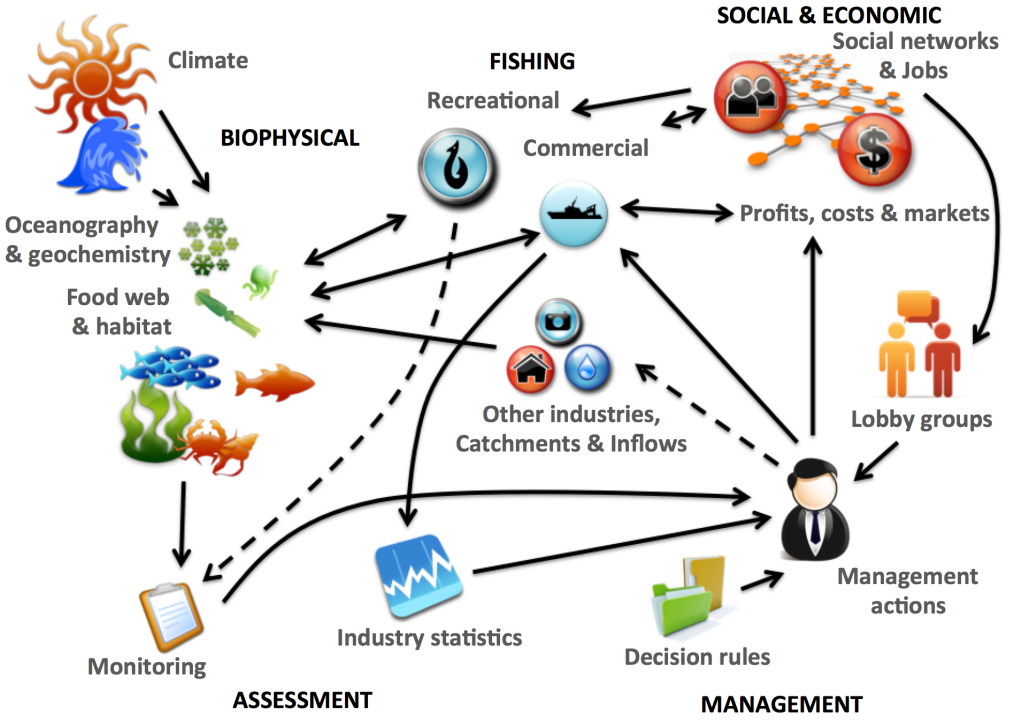
- Severe increase in aridity
  Karnauskas *et al.* 2016
- Increase in seawater temperature



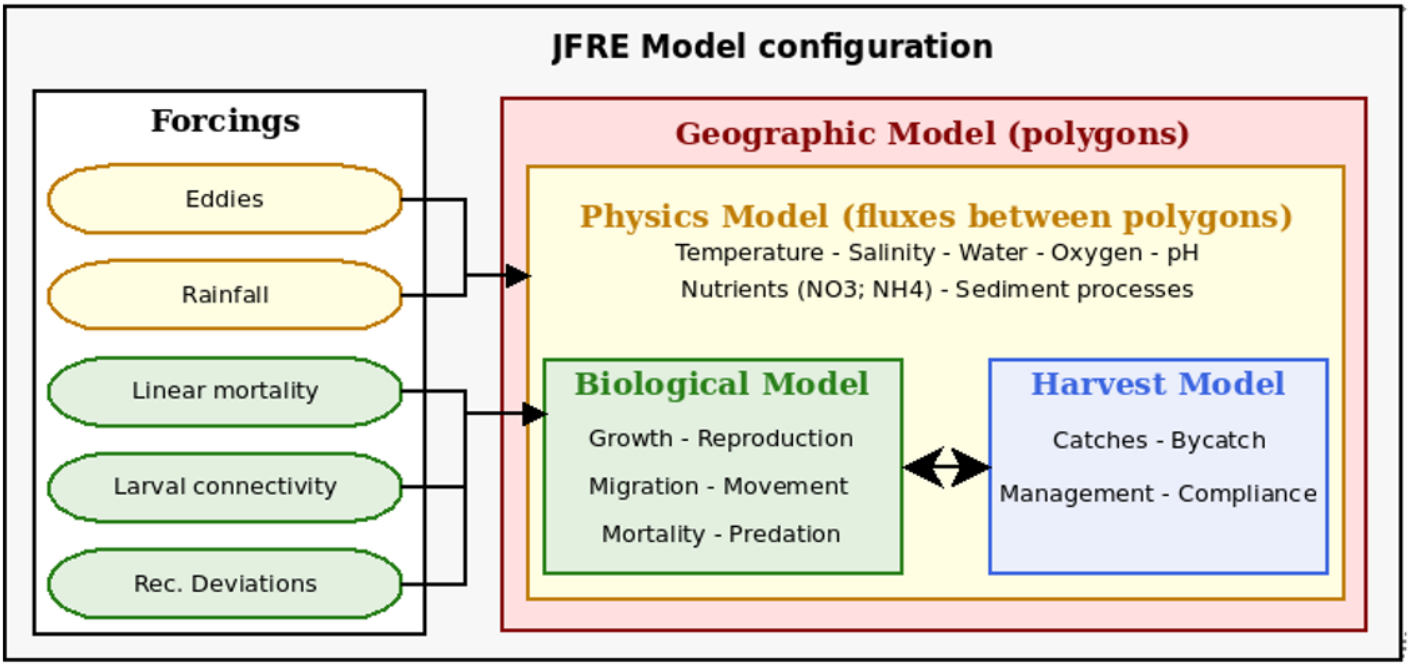
Uncertain socio-ecological future



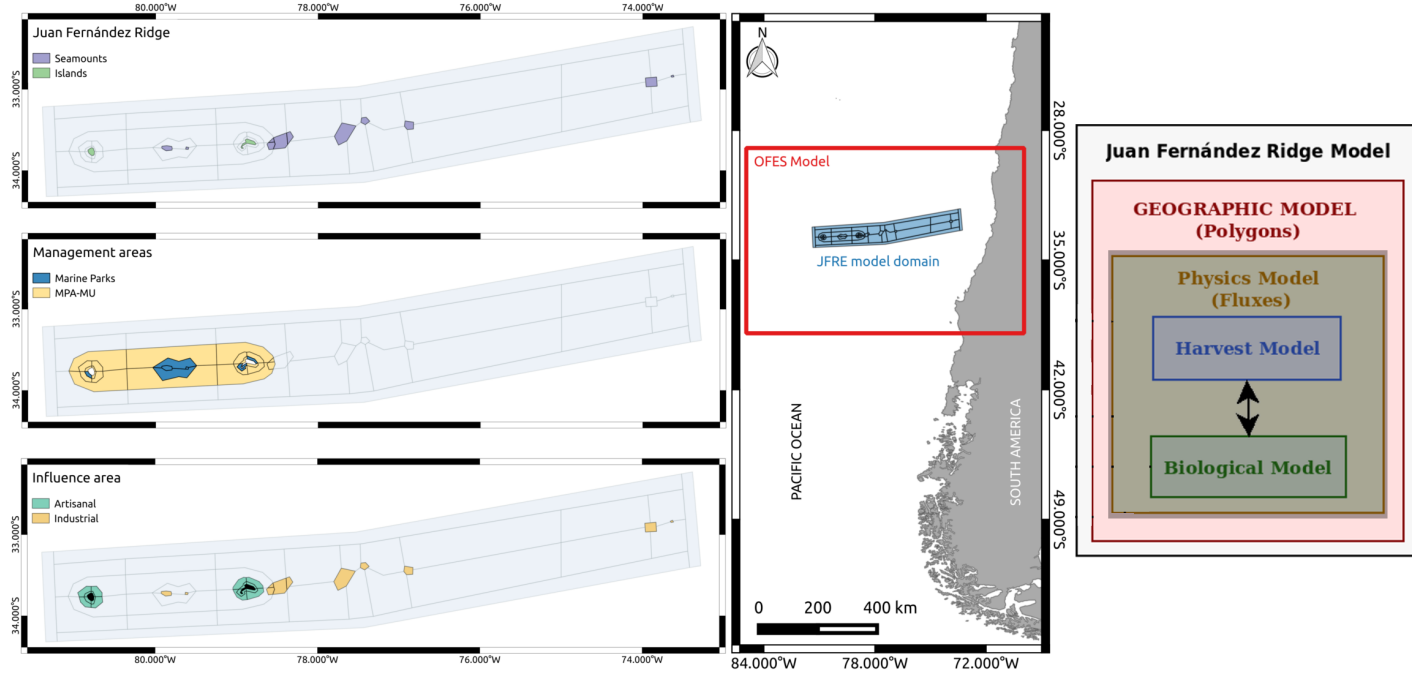
Assessing the impact of Climate Change in JFRE



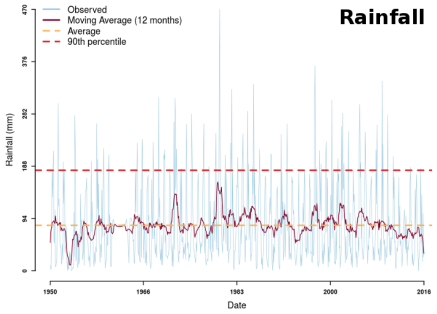
Assessing the impact of Climate Change



JFRE - Spatial configuration

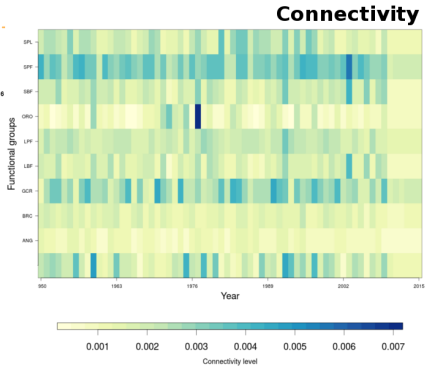


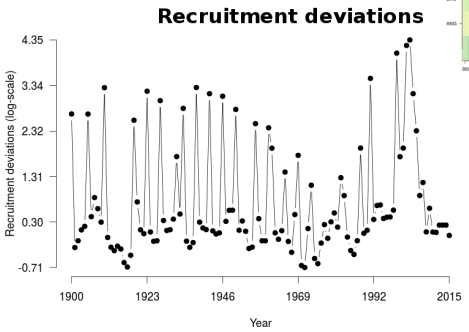
JFRE - Ecology and main forcings

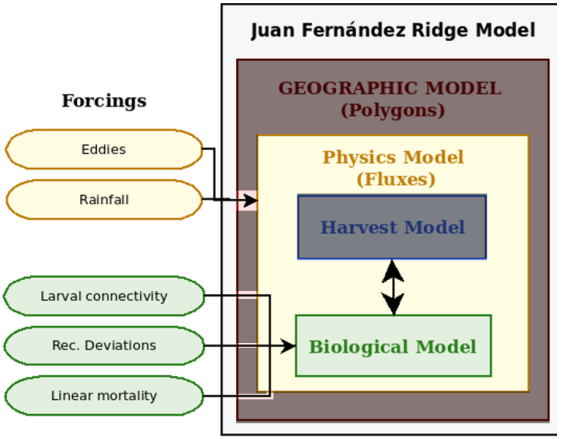


34 functional groups
16 Age-Class

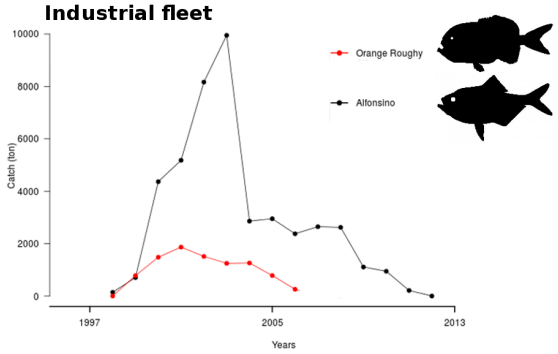
18 Biomass pool

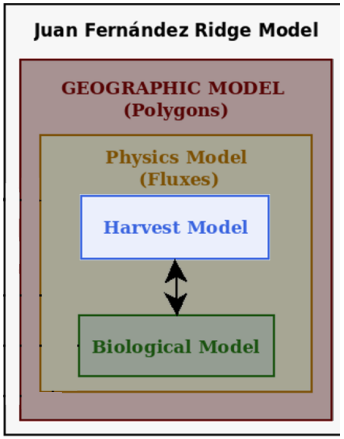




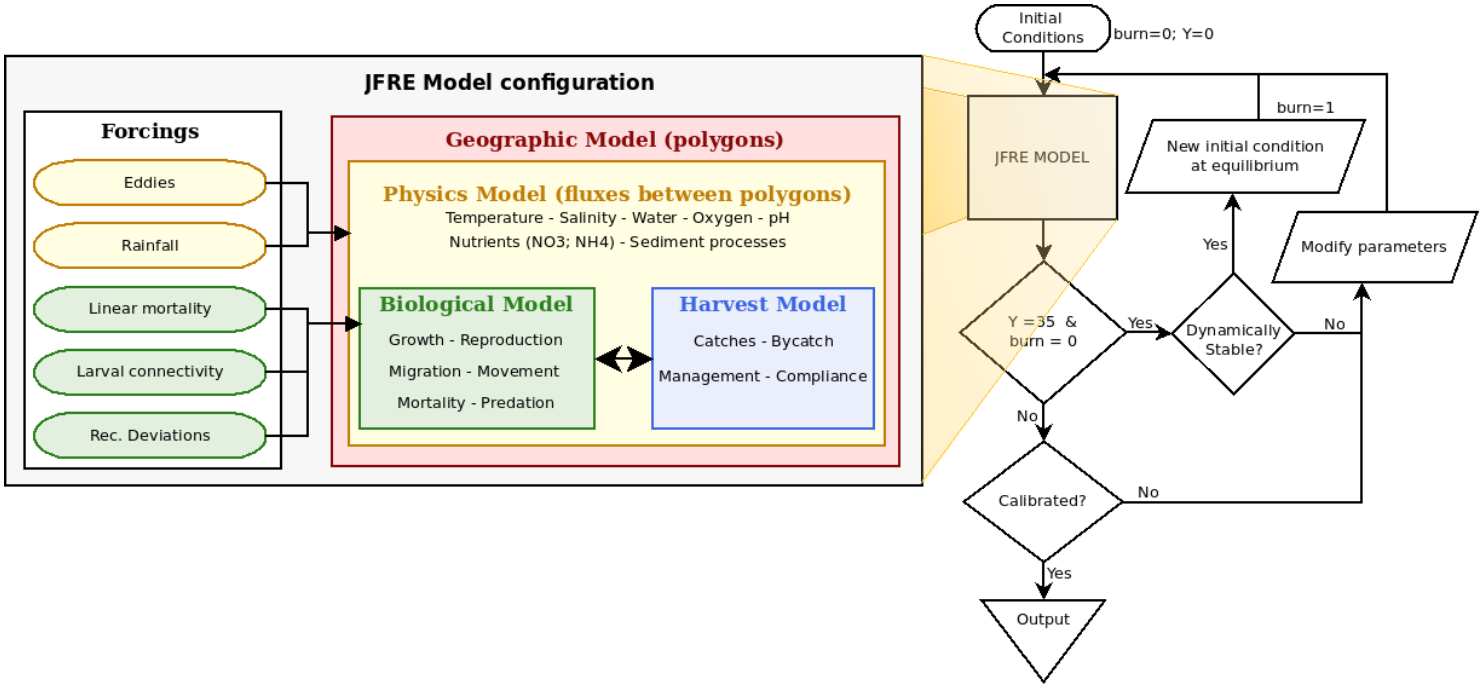


JFRE - Fisheries



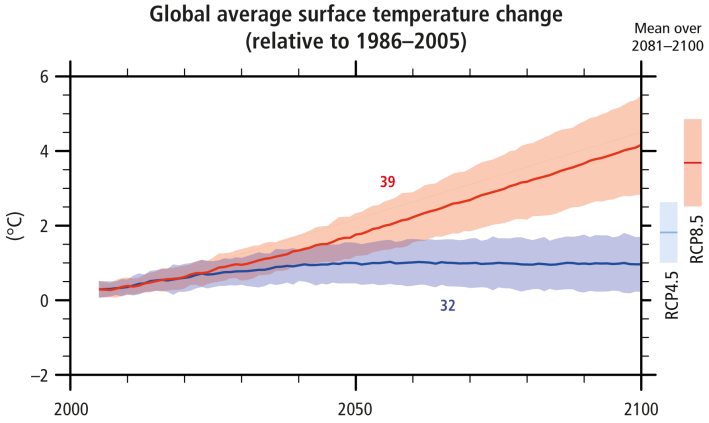


Assessing the impact of Climate Change

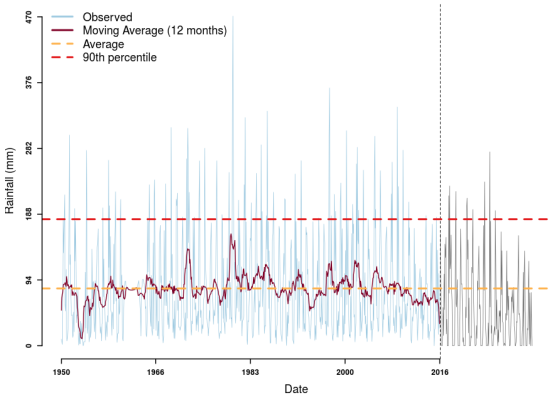


Including Climate Change

- RCP - Pathways



- Rain projections



Scenarios

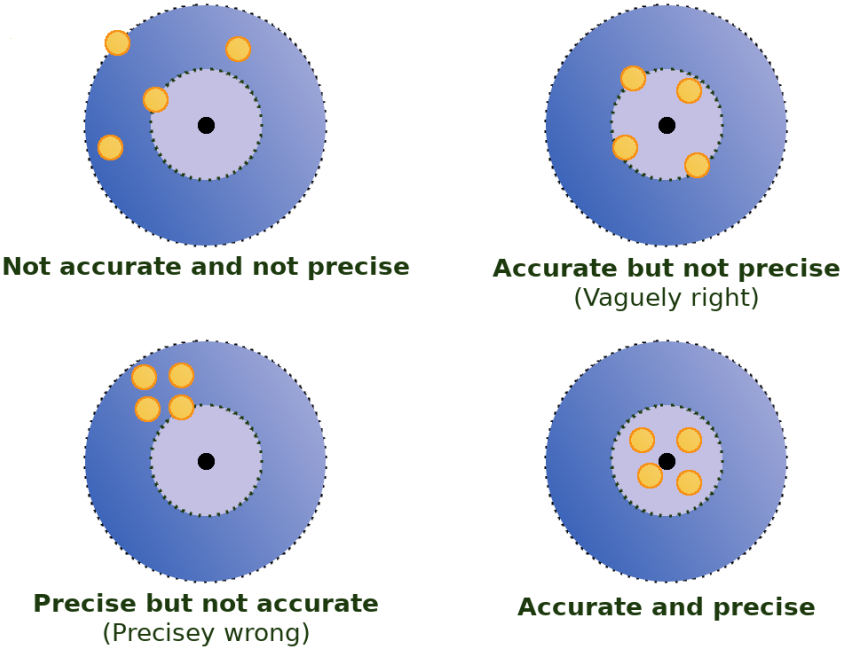
- Historical effect of fishing.

Scenarios	Fishin mortality	Fleet
Unfished	No fishing	-
Historical Artisanal	Artisanal	Artisanal
Historical Industrial	Industrial	Industrial
Historical JFRE	Historic levels	Both

- Future fishing scenarios.

	Crustacean **C**		Finfish **F**	C. Change
Scenario	SPL	GCR		RCP 4.5&8.5
BAU	-	-	-	✓
50%↑ **C+F**	↑	↑	↑	✓
300%MIX	↓ 20%	↑	↑	✓

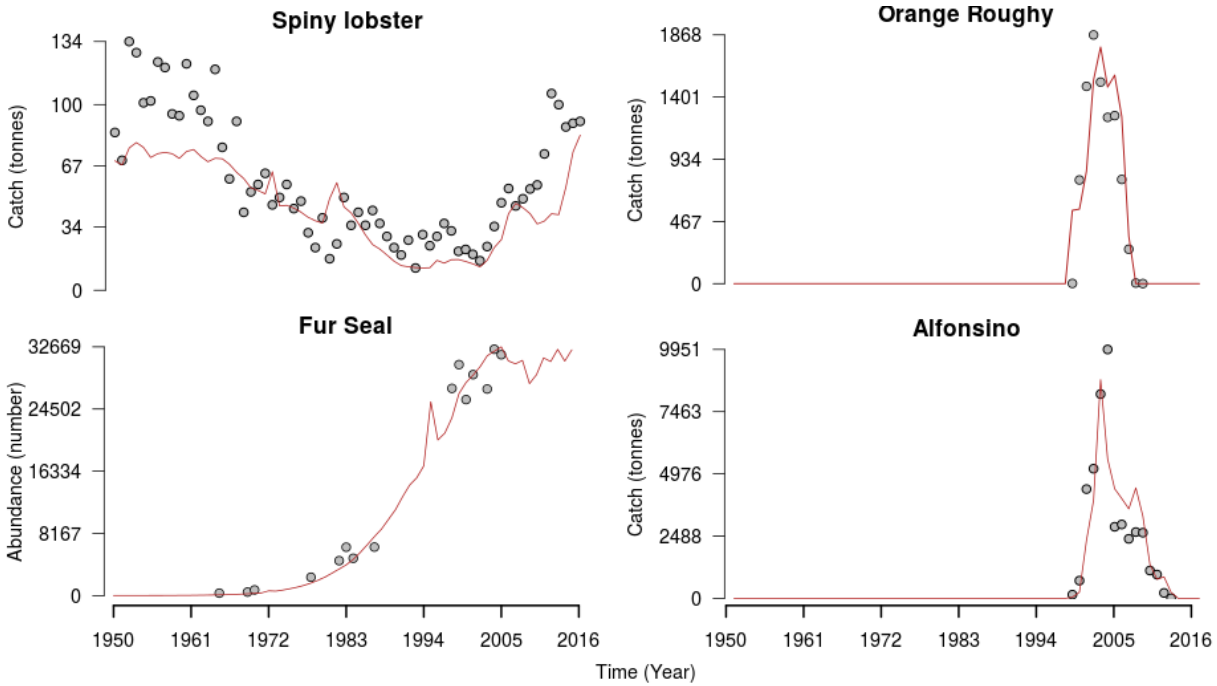
Model skill assessment



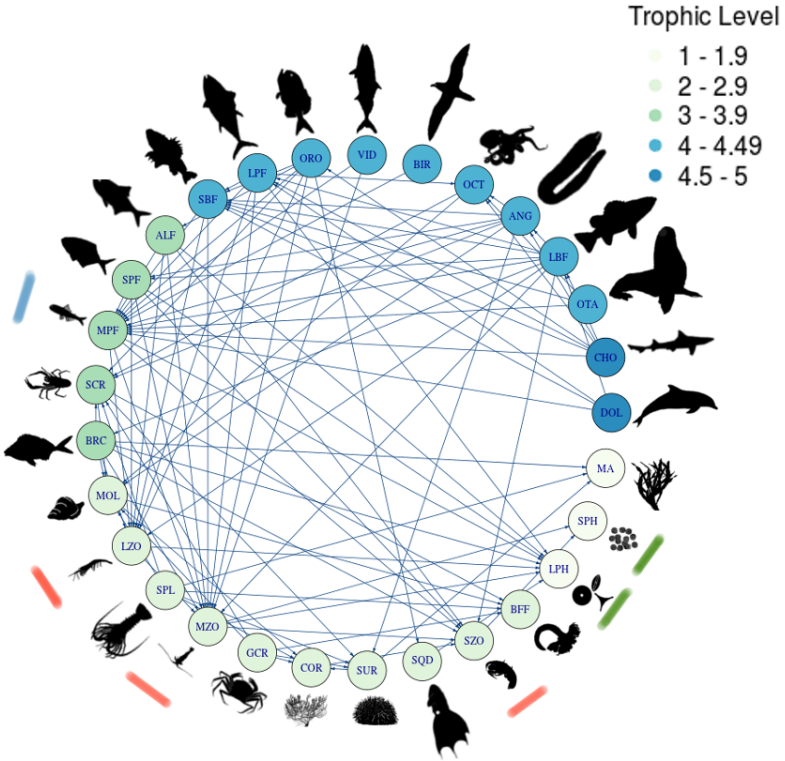
Stow et al. 2009; Olsen et al. 2016

Model skill assessment

Model Efficiency ∼1 Correlation ∼0.9

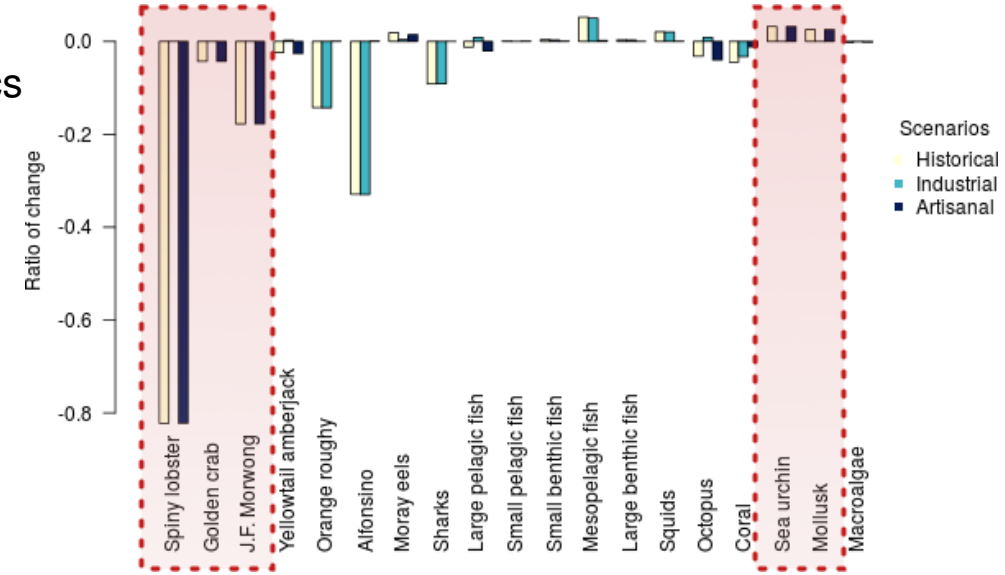


Trophic levels



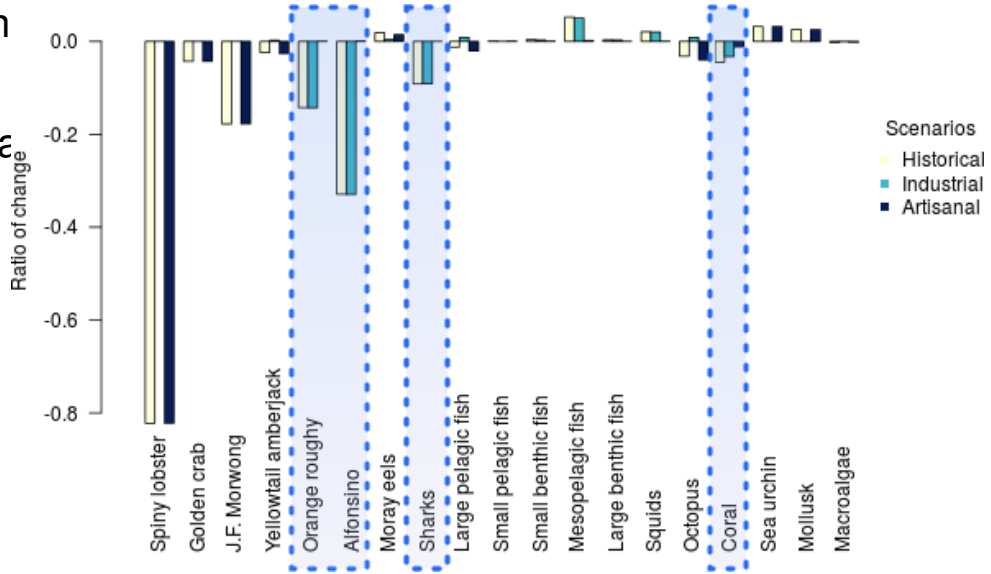
Historical effect : Artisanal

↓ High impact on Lobster
↑ Sea Urchin and Molluscs

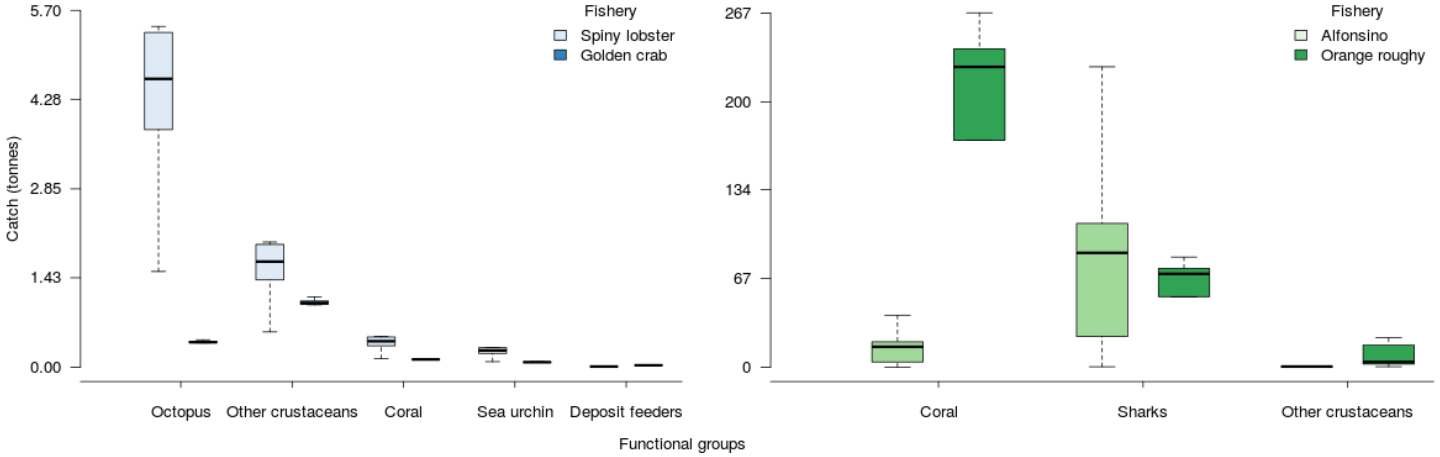


Historical effect : Industial

- ↓ Orange roughy and Alfon
- ↑ Mesopelagic fishes
- ↓ Bycatch of Coral and Sha

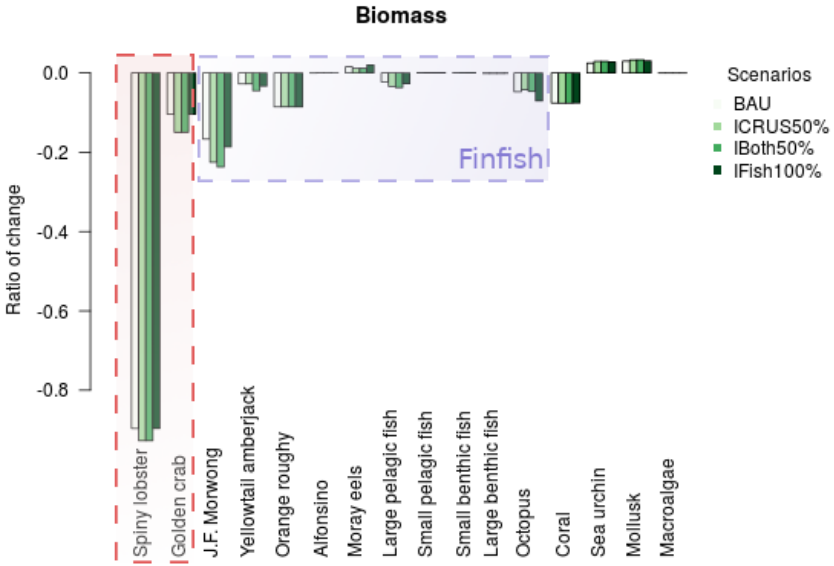


Historical effect : Bycatch



Compared with an unfished scenario

- Similar results
  - ↓ Crustaceans and Morwong
- ↑ No big effect on Finfish.
- Orange Roughy still recovering
- Increase in effort is not reflected in lobster biomass



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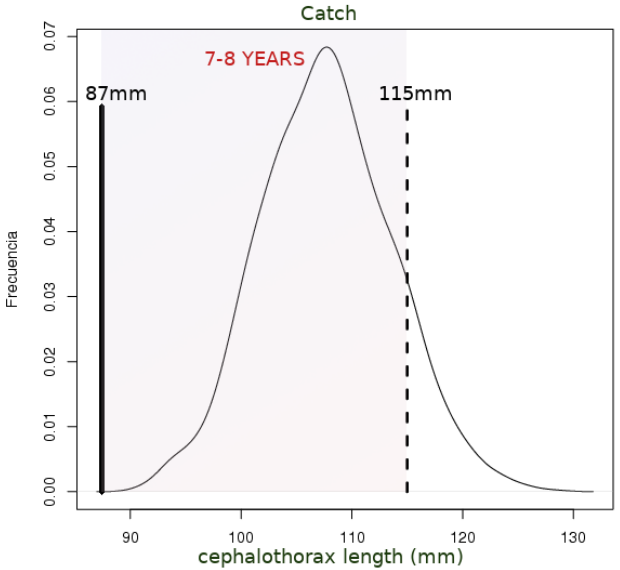
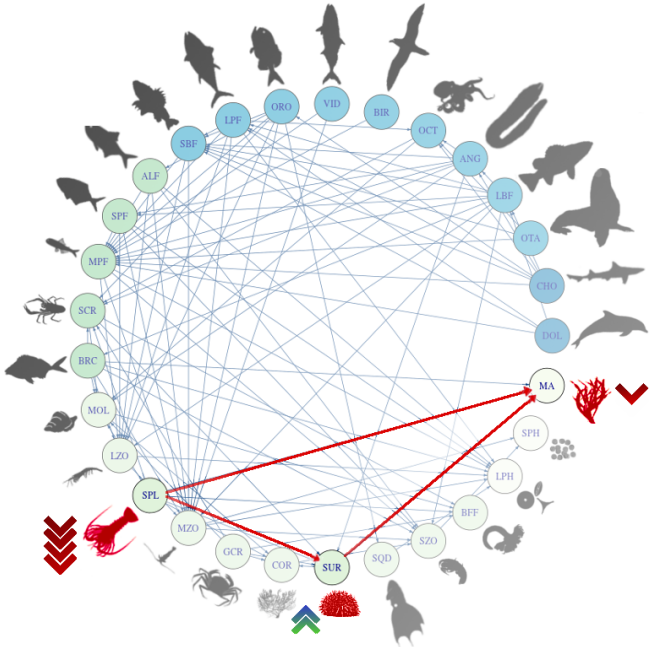


How much Risk?

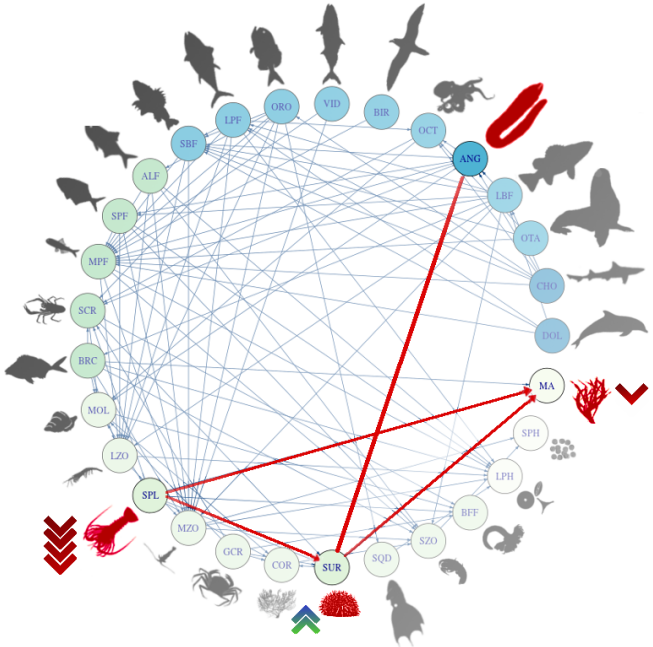
Scenario	Species	Catch	Biomass	Income	Risk
BAU	Spiny lobster	-	⇓	-	**Moderate**
	Golden crab	-	-	-	**Low**
	Finfish (BAIT)	-	⇑⇑	-	**Low**
	Finfish (Market)	-	⇑⇑	⇑	**Low**
50%↑ **C+F**	Spiny lobster	⇓	⇓	⇓	**High**
	Golden crab	⇑	-	⇑	**Low**
	Finfish (BAIT)	⇑	⇑⇑	-	**Low**
	Finfish (Market)		⇑⇑	⇑	**Low**
100%↑ **F**	Spiny lobster	-	⇓	-	**Moderate**
	Golden crab	-	-	-	**Low**
	Finfish (BAIT)	-	⇑⇑		**Low**
	Finfish (Market)	⇑	⇑⇑	⇑⇑	**Low**
300%MIX	Spiny lobster	⇑	⇓	⇑	**Moderate**
	Golden crab	⇑⇑	⇑	⇑	**High**
	Finfish (BAIT)	⇓	⇑⇑	-	**Low**
	Finfish (Market)	⇑⇑	⇑⇑	⇑⇑	**Low**

Foodweb dynamics



- Similar dynamic to other ecosytems
- Slow growth of sea urchin population

Foodweb dynamics



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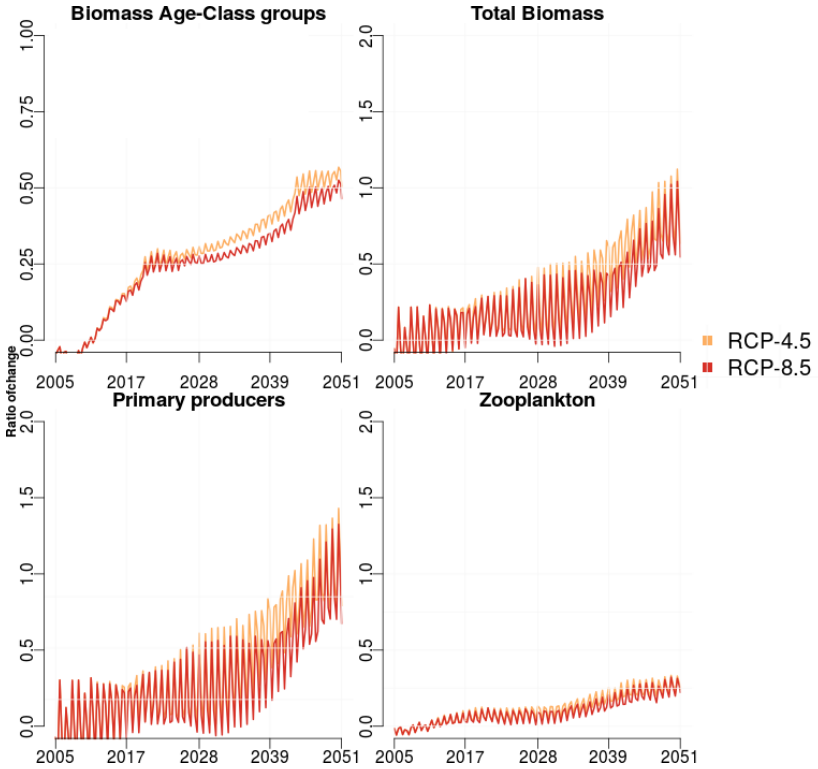
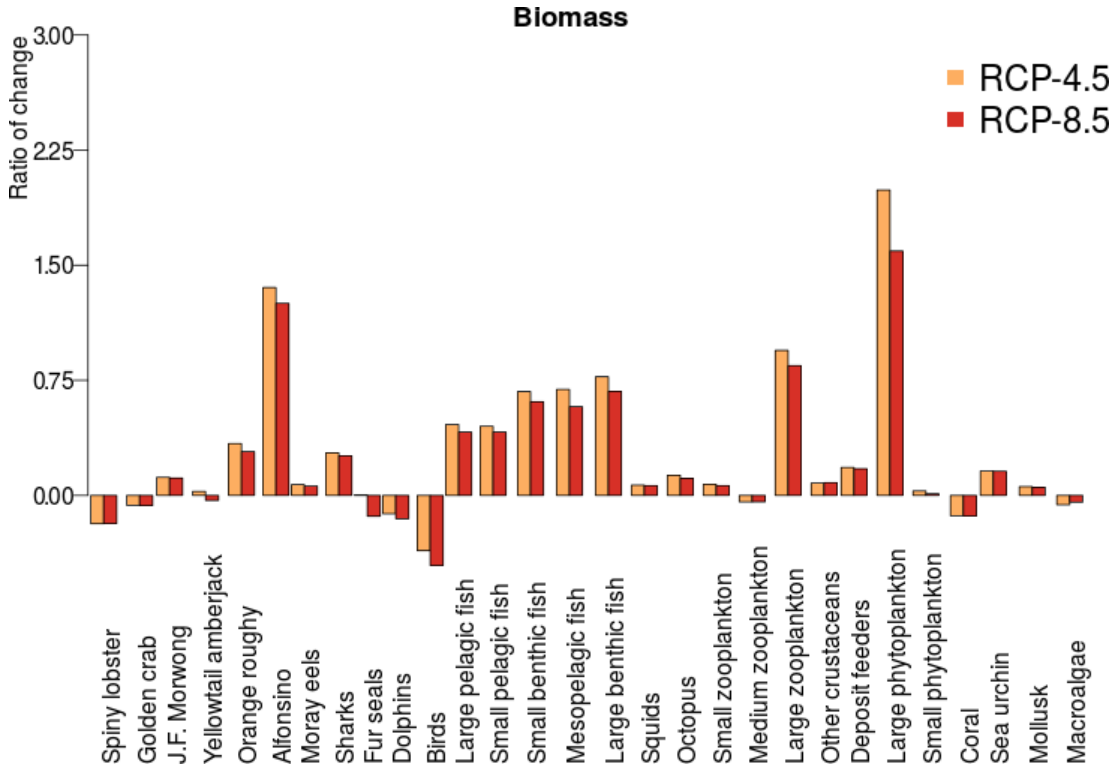
Time Series Projections



Compare by functional groups



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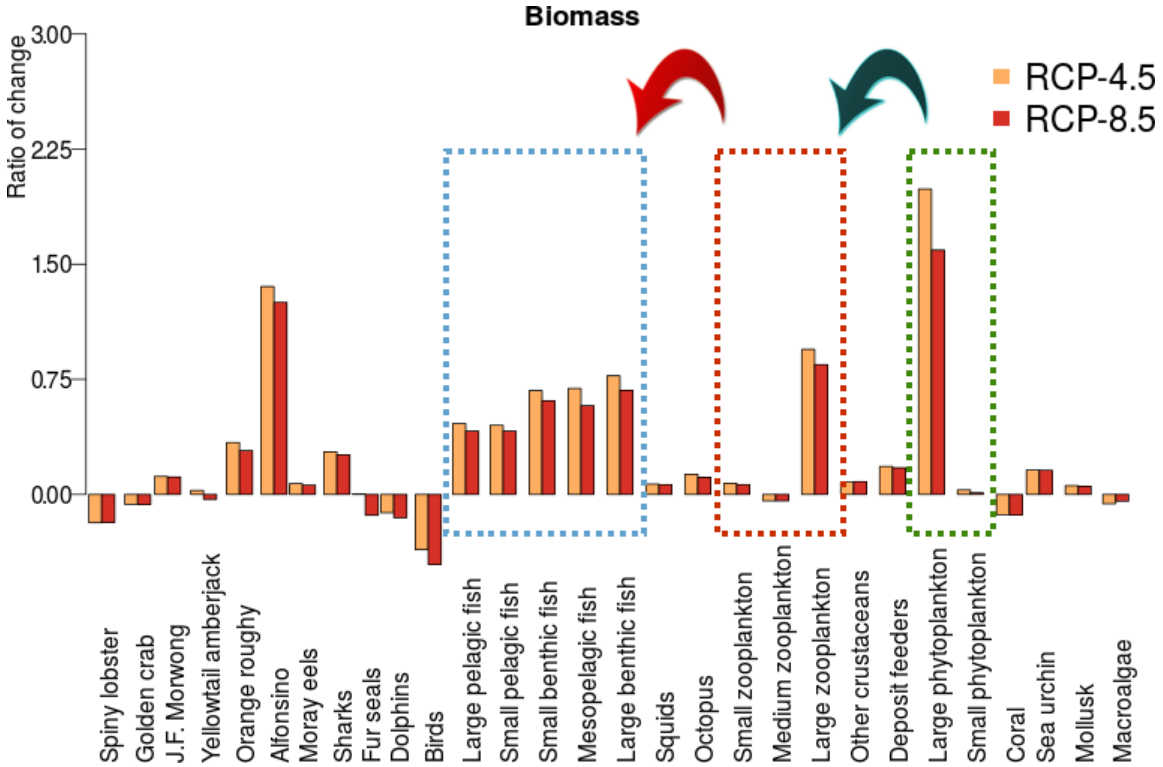
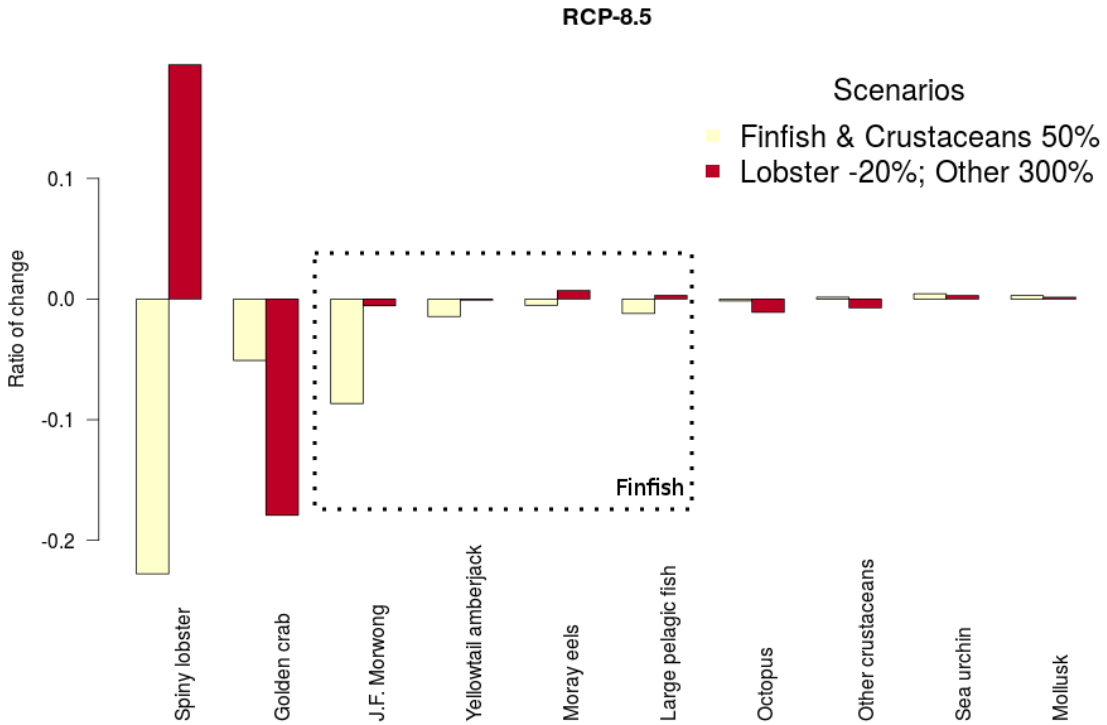
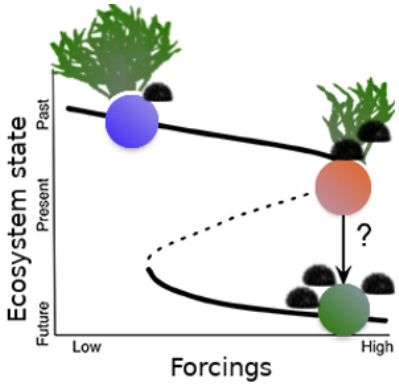


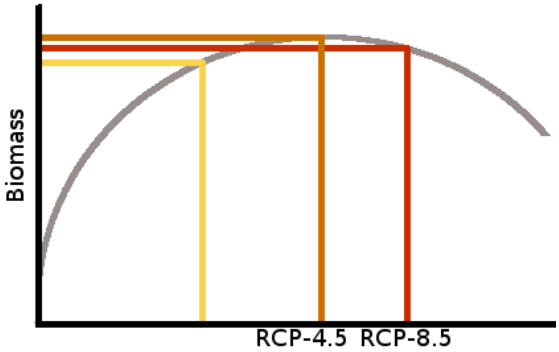
Cumulative effect : CC + Fisheries



Conclusion

- Controlled by primary production
- Low impact from the artisanal fisheries
- Increase in the sea urchin population
- The ecosystem is not at optimal dynamical state





Thoughts for the future

Biology
- Biomass
- Recruitment
- Energetic costs

Modelling
- Bio-energetic
- Integrating CC stressors

Management
- New meassures
- Foster diversification

Thank You

Ocean & Atmosphere

Javier Porobic
t +61362325037
e javier.porobicgarate@csiro.au
w Javier Porobic