



tafi

Tasmanian Aquaculture
and Fisheries Institute



Tasmania
Explore the possibilities

Building from the inside out

Incorporating the human and biological dimensions into fisheries models.

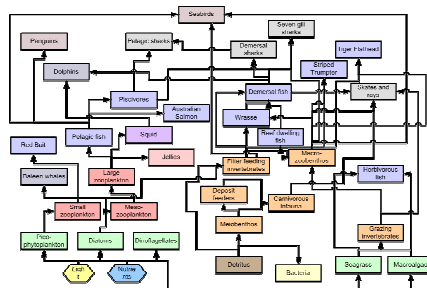
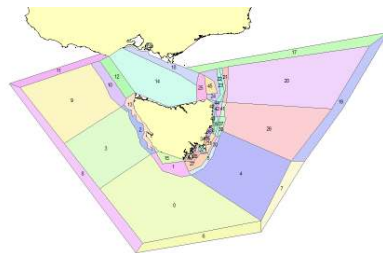
TAFI is a joint venture between the State Government and the University of Tasmania

		Consequence					
		Negligible	Minor	Moderate	Severe	Major	Catastrophic
Likelihood	Remote	1					
	Rare	2					
	Unlikely	3					
	Possible	4					
	Occasional	5					
	Likely	6					

Qualitative –
Expert opinion

Regression analysis,
correlations
differential equations

Single species
fisheries
assessment
models



Ecosystem
models – Large
scale quantitative
datasets

Complex systems models
Agent based models
Individual based models

Fisheries models do offer some advantages – especially in the early stages of moving to an integrated approach

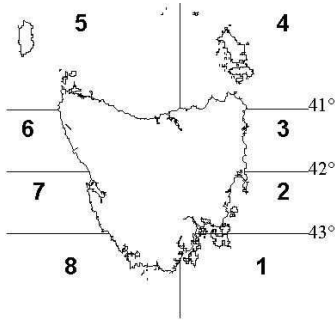
Improved stakeholder understanding

- Familiar terminology**
- Understanding of outputs**
- Comfortable with process**

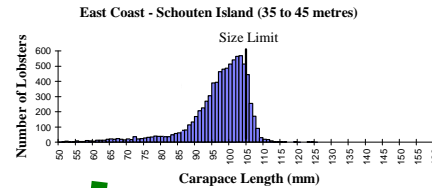
Improved stakeholder engagement

Biological Model

Catch and Effort
(Commercial
logbooks)



Size Structure
(Research surveys)



Growth
(Tagging data)



Recreational Catch
(Survey estimates)



Regional Biomass

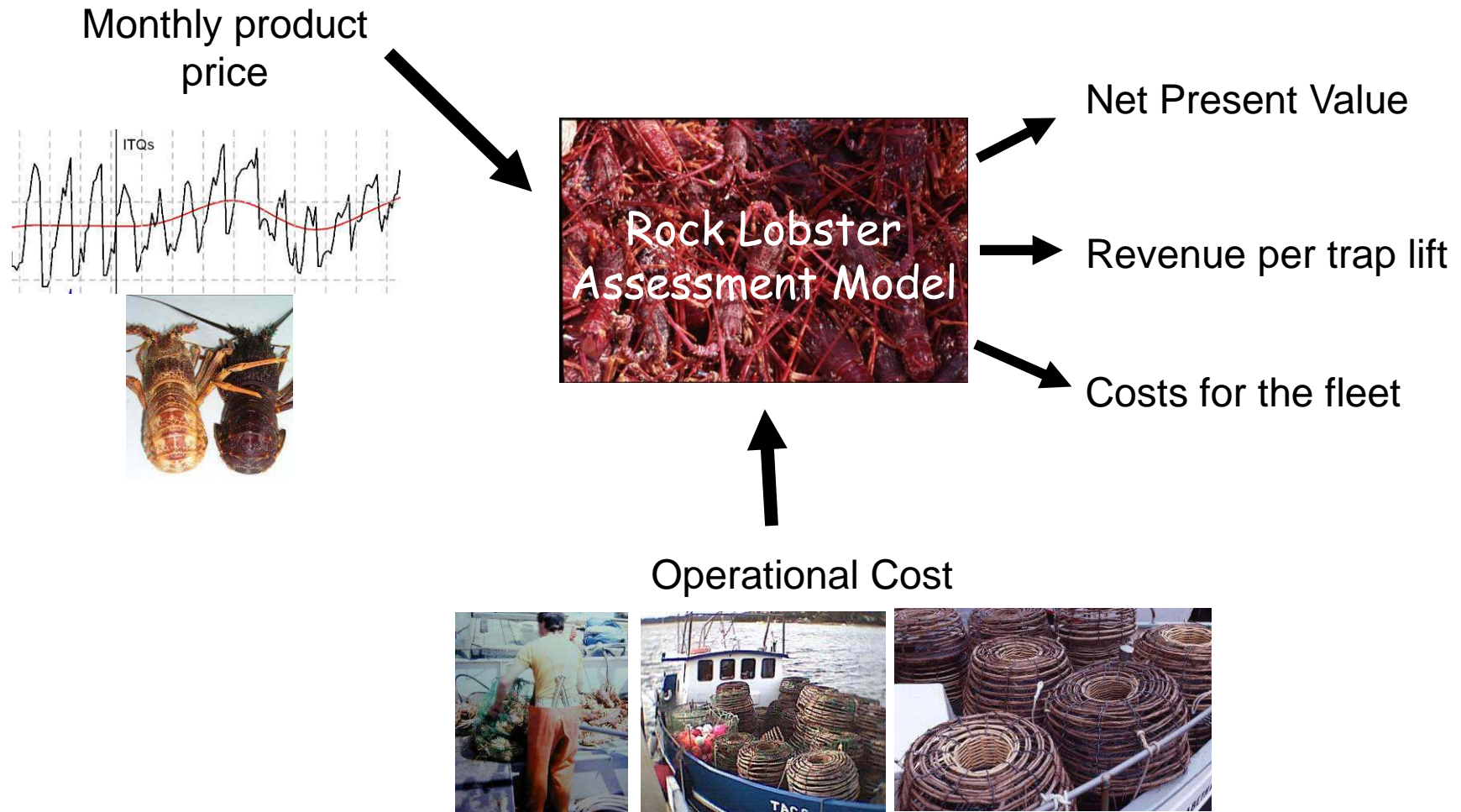
Regional Egg Production

Harvest Strategy Evaluation

Forward projections

- Reg. Exp Biom
- Reg. Egg Prod
- Reg. Catch distribution

Economic parameters (1)



Economic parameters (2)

Attributes of the fisher/decision taker

- quota allocation incl. quota price
- vessel characteristic
- harbour of origin...

Attributes of the choice

- catch rate,
- lobster price,
- distance from home,
- weather...



**Fleet dynamics
sub-model
(Katell's PhD)**



Influences
economic and
biological
outputs by
distributing
the fleet
amongst
regions

**MSE
&
Predictions**



Ecosystem metrics (1)- Lobster impacts on the ecosystem



Estimates of biomass of
different size categories of
lobsters

Behavioural impacts
(abalone emergence)

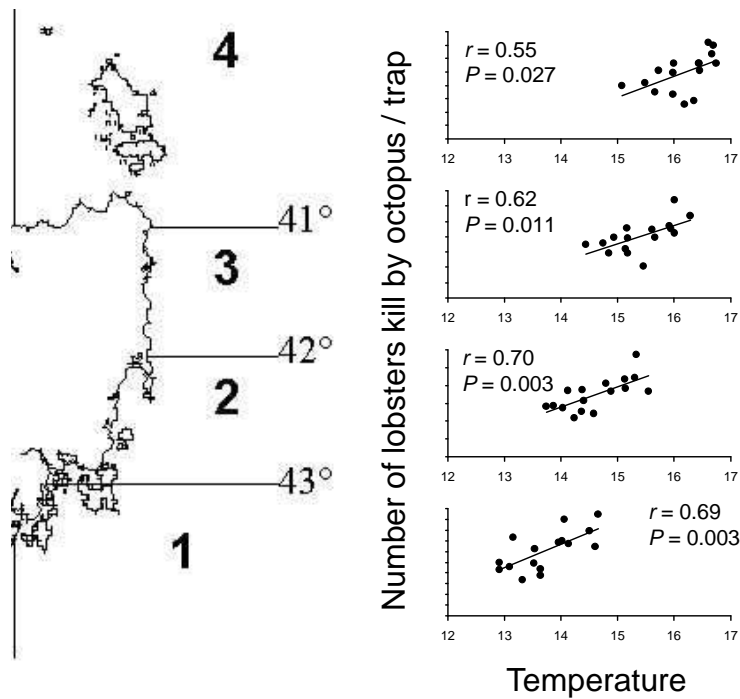


Predation events
(PhD – dietary DNA)



Ecosystem models
(e.g. Martin's PhD)

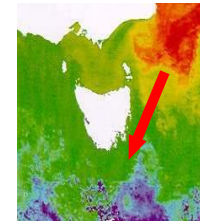
Ecosystem metrics (2) – Climate Change: Ecosystem impacts on lobsters



Relationship between octopus predation in lobster traps and temperature



Adjust natural mortality (M) input parameter



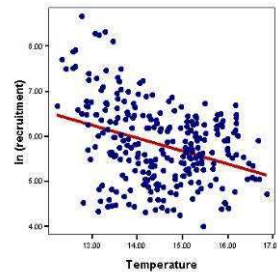
°C



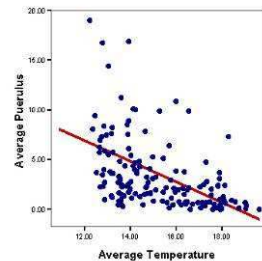
Rock Lobster Assessment Model

Ecosystem metrics (3a) – Climate Change: Physical impacts on lobsters

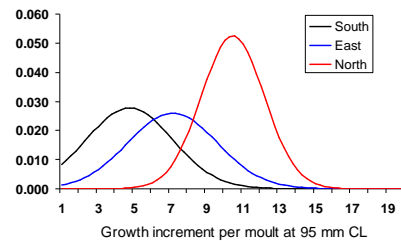
Assessment model
hindcast recruitment
estimates



Puerulus settlement



Temperature
dependent
growth

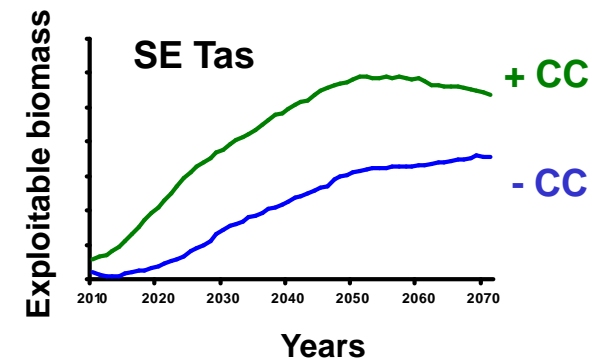


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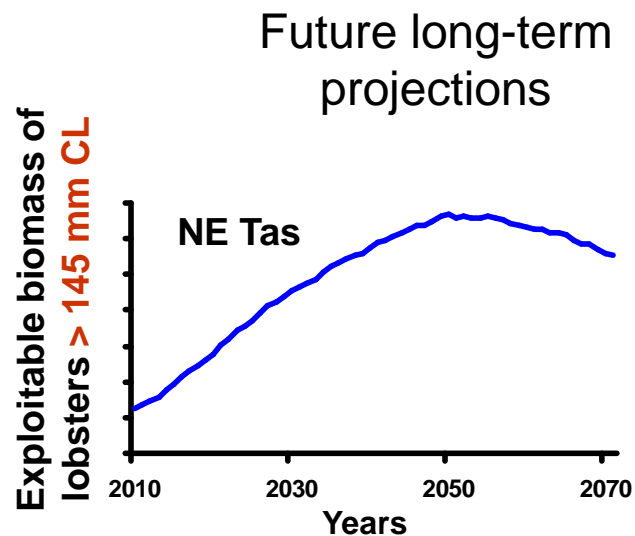
Future long-term
projections



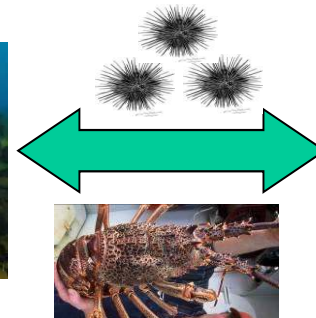
Ecosystem metrics (3b) – Climate Change: Physical impacts on lobsters → Urchins

Recruitment impacts $^{\circ}\text{C}$

Growth impacts $^{\circ}\text{C}$



Ecosystem model



Social Issues

Recruitment impacts

$^{\circ}\text{C}$

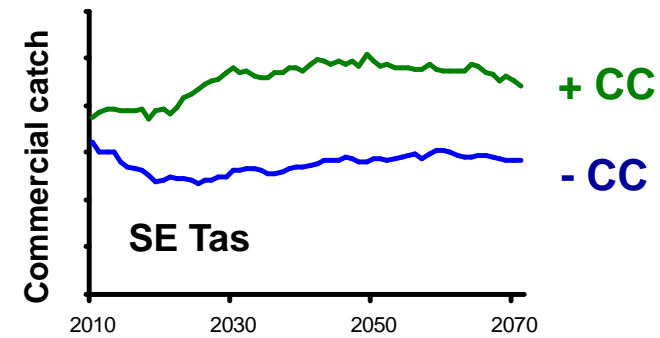
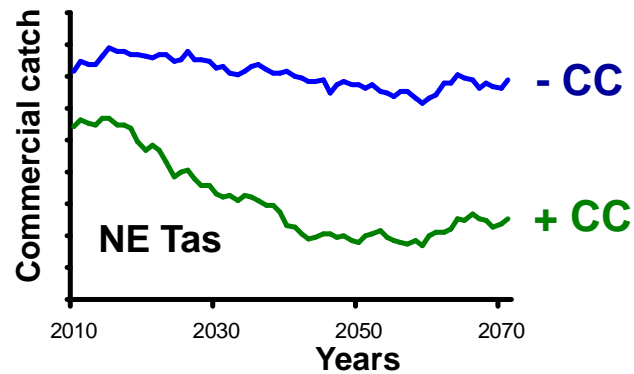
Growth impacts

$^{\circ}\text{C}$



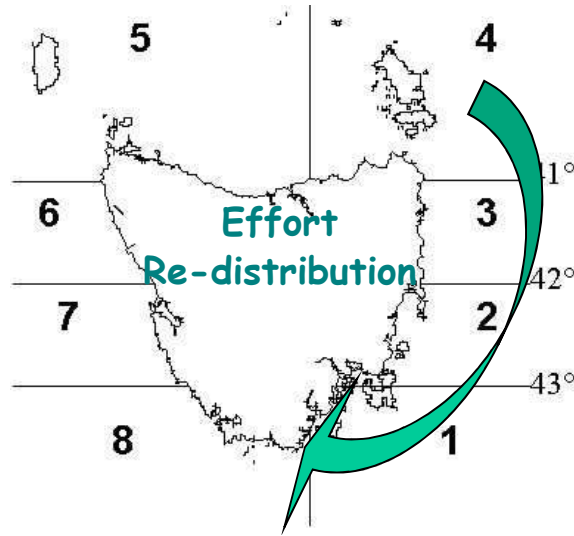
Fleet dynamics
model

Future projections



Change in activity of fleet from northern to southern Tasmania

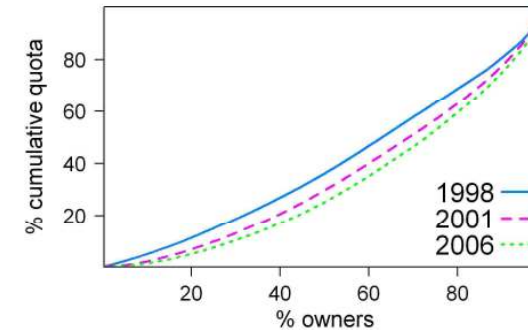
Social Issues



Re-distribution of people/wealth with flow-on effects on rural communities

Changes in employment opportunities

Increase in flexibility of incomes?



Concentration of quota:

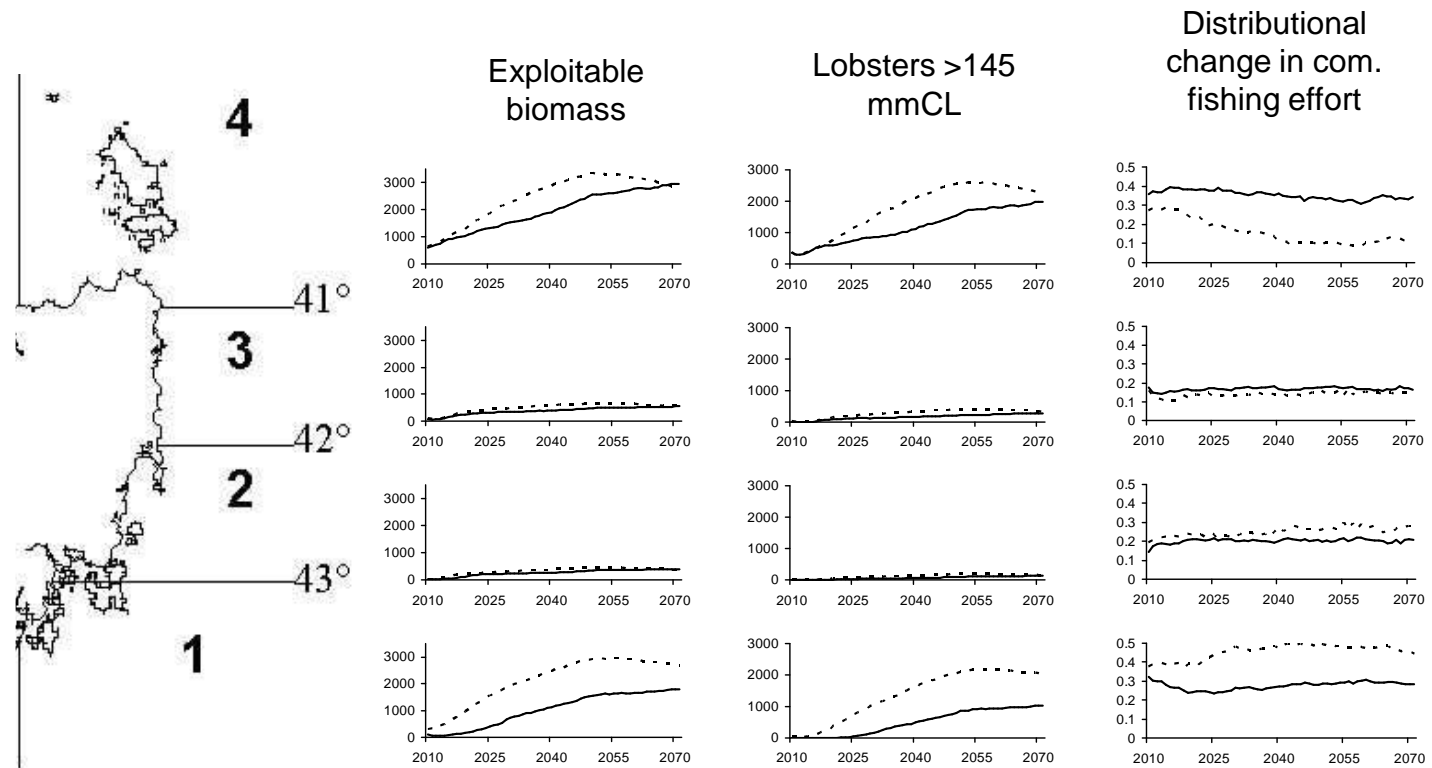
In 1998 **~38%** of quota held by 50% of owners.

By 2006 = **~25%** of quota held by 50% of owners.

Conclusion

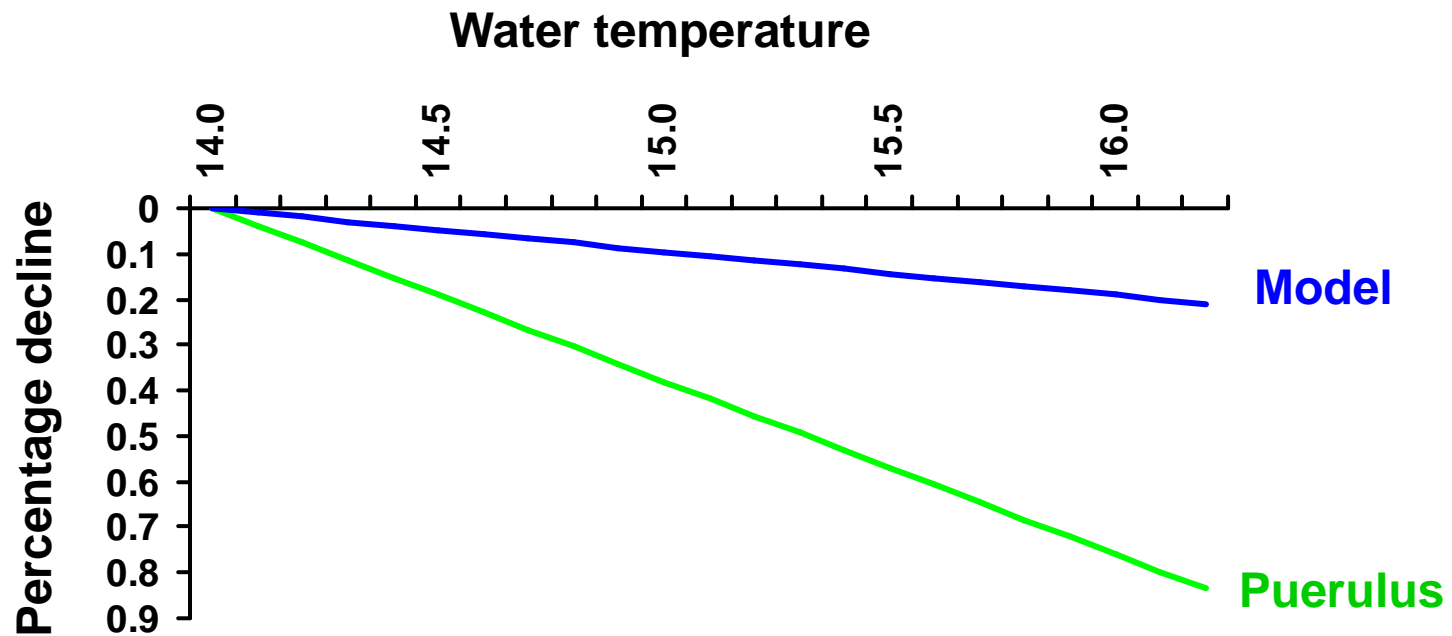
Existing fisheries models can:

- provide opportunities to capture ecosystem, economic and social dimensions of the human-ecological system
- can be used to provide important links to other models (ecosystem, economic and social)



Possible Fig 3. Increases in growth rate of lobsters, especially in southern regions of the fishery, result in initial improvements in the predicted estimates of exploitable biomass (left panel) and large lobsters that are capable of consuming urchins (middle panel). In all cases a tipping point is reached when recruitment decline outstrips growth improvements in productivity of the resource. Although northeastern Tasmania is predicted to have the initial impact of recruitment declines and limited improvement in growth rates, biomass increases as effort moves to southern regions (right panel). Solid lines are equivalent projections without accounting for climate impacts on recruitment and growth.

Comparison between the percentage decline in observed **puerulus settlement** trends at Bicheno and estimated **model recruitment** trends for Area 3.



- Model estimated recruitment shows a slower decline with temperature.
- Reality may be somewhere between both.



Likelihood			Consequence						
			Negligible		Minor	Moderate	Severe	Major	Catastrophic
			0	1	2	3	4	5	
Remote	1	0	0	0	1	1	2		
Rare	2	0	1	1	2	2	2		
Unlikely	3	0	1	2	2	2	3		
Possible	4	0	1	2	3	3	4		
Occasional	5	0	1	2	3	3	4		
Likely	6	0	1	2	3	4	4		

		Negligible	Minor	Moderate	Severe	Major	Catastrophic
		0	1	2	3	4	5
Remote	1						
Rare	2						
Unlikely	3						
Possible	4						
Occasional	0						
Likely	0						