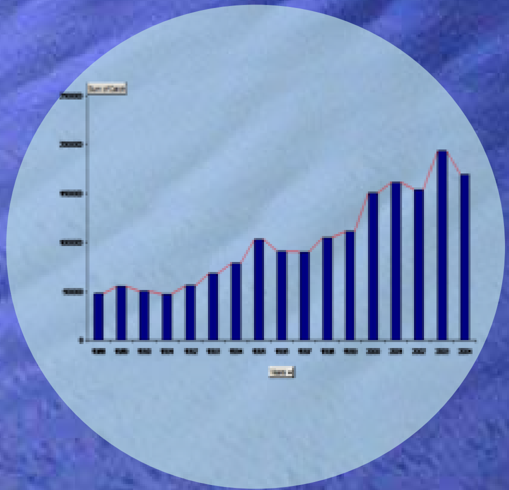
Australian Rivers Institute

Griffith University

Effect of climate “*change*” on estuarine fish production in Queensland, Australia

J.-O. Meynecke



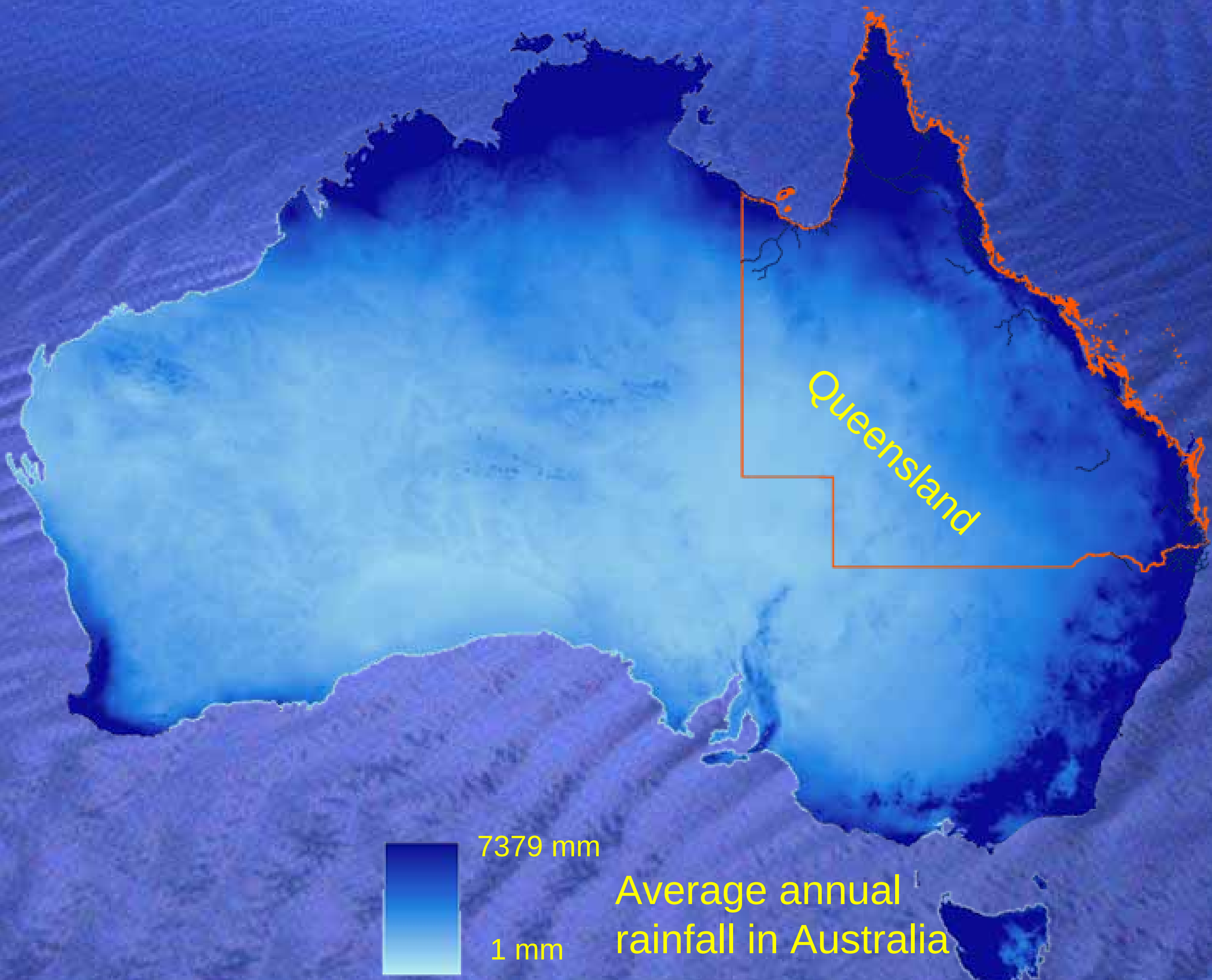
Study location

Intro
Climate
Methods
Results
Summary and Outlook

Study objectives

- **I**s there a relationship between fish catch and climate parameters and how strong is it?
- **W**hat are the differences between regions and species?
- **C**an the relationship be used for modelling?
- **W**hat are the consequences for fisheries management?

Rainfall in Australia



Intro

Climate

Methods

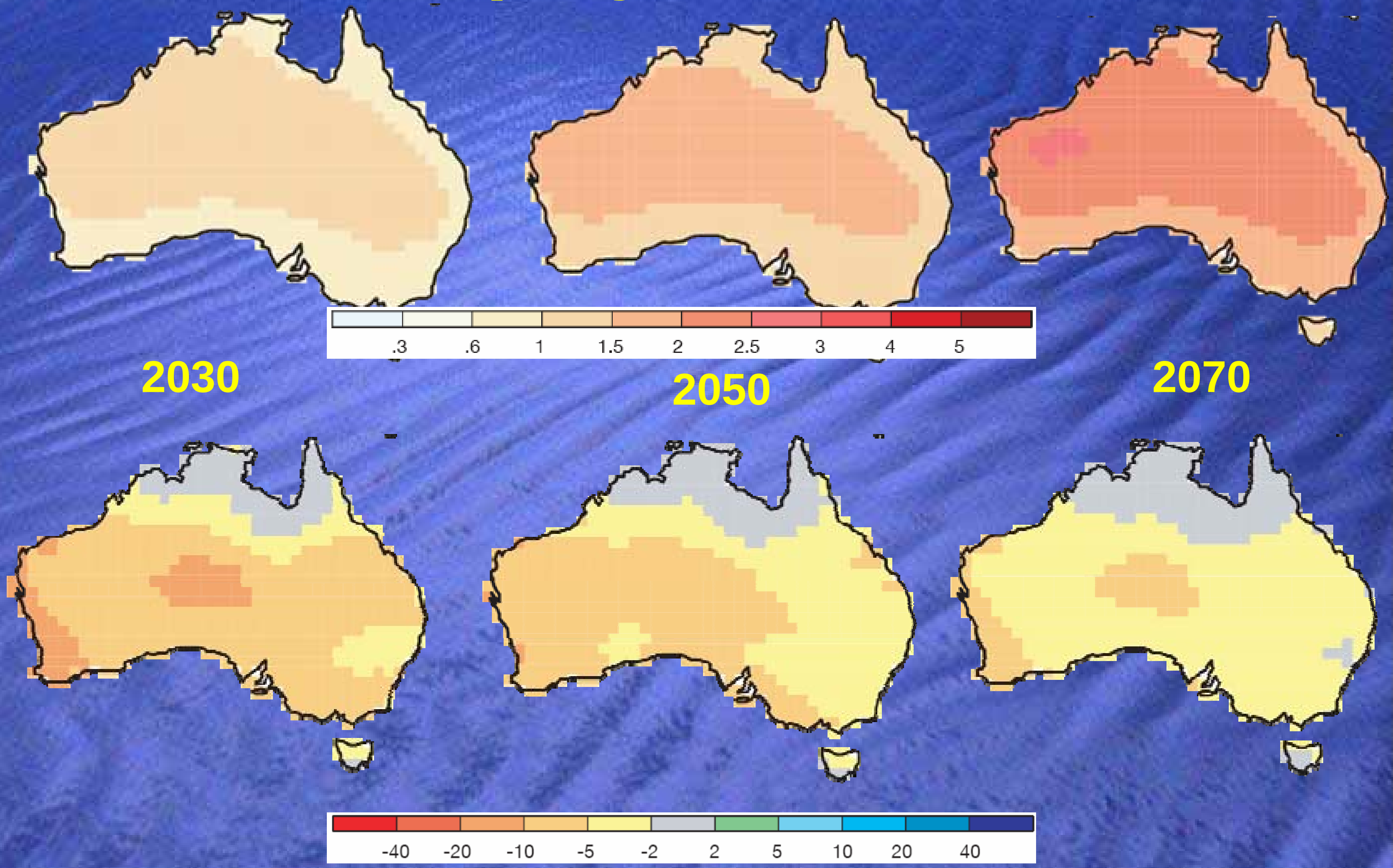
Results

Summary and Outlook

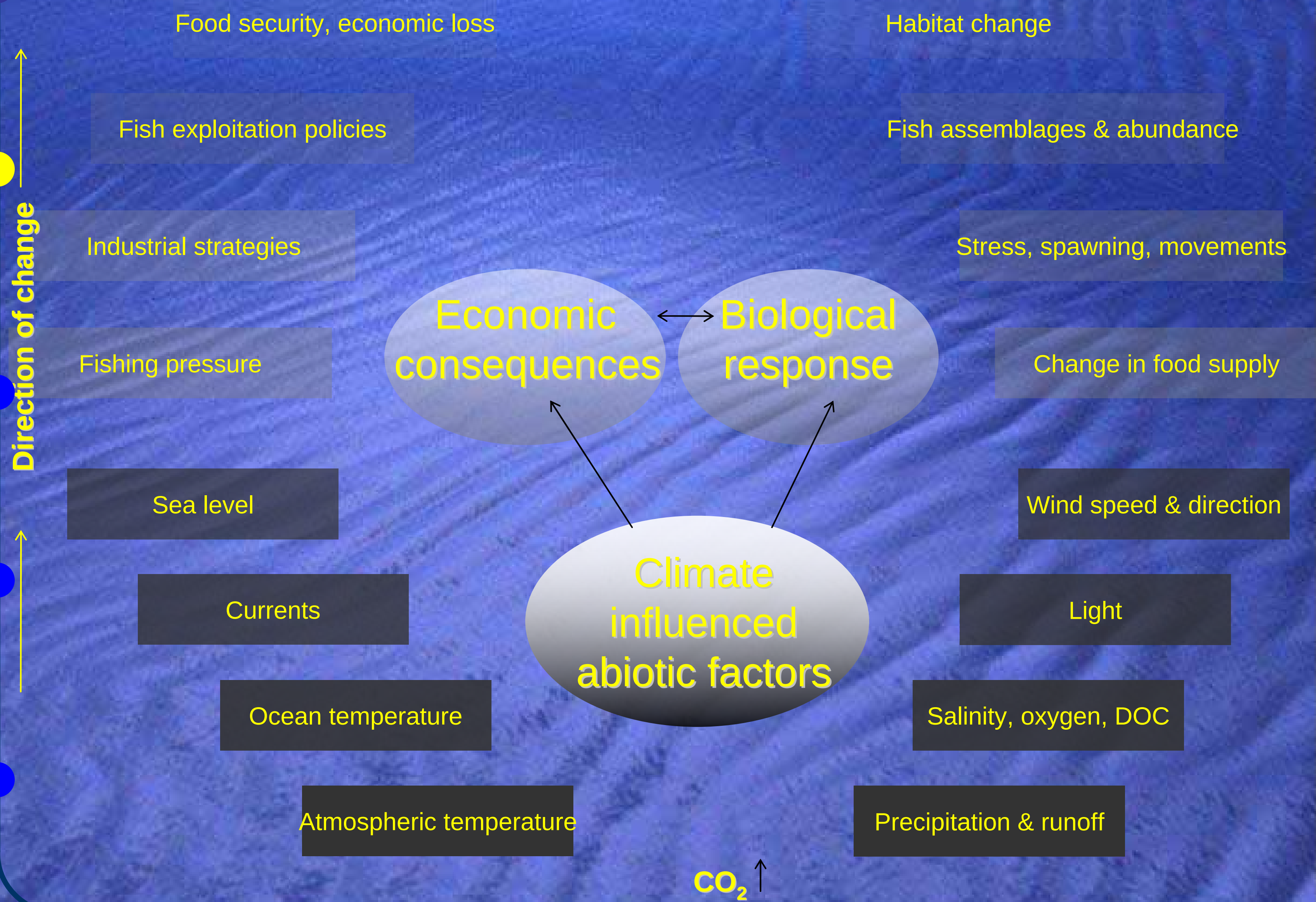
Temperature in Australia

Intro
Climate
Methods
Results
Summary and Outlook

Rainfall and temperature projections



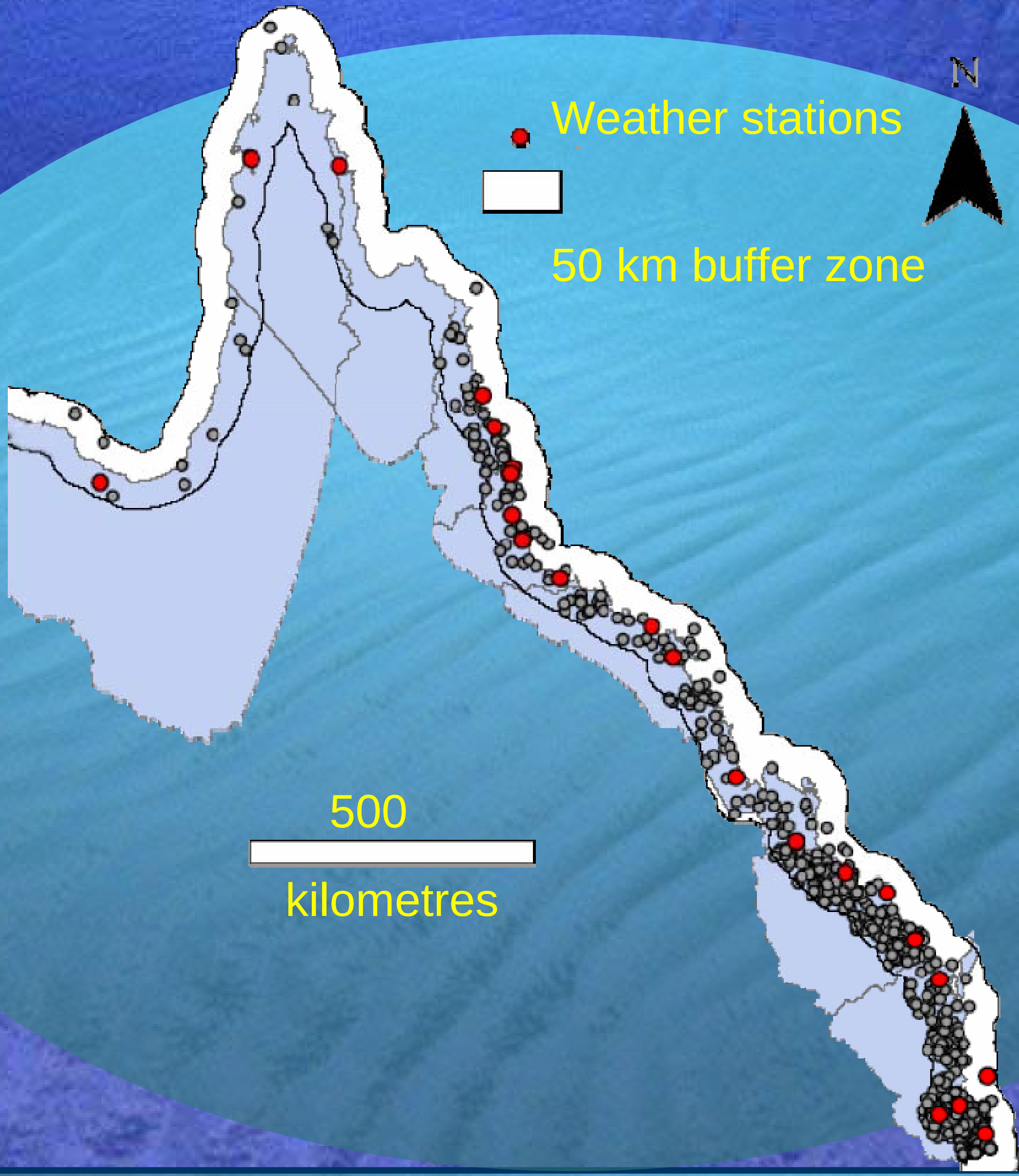
Climate and fisheries



Selection of species

Selection of rainfall regions

Selection of stations



Fish record grid system

Intro
Climate
Methods
Results
Summary and Outlook

Climate and fish catch data

Intro

Climate

Methods

Results

Summary and Outlook

- **D**ata on catch, effort (number of days and boats) and gross value of production for fish species from 1988-2004 were provided by DPI&F

- **A**nnual and monthly temperature data were provided as point data and rainfall data as average values for 8 coastal regions for the time period 1988-2004 were obtained from BOM

Intro
Climate
Methods
Results
Summary and Outlook

Tools

- **R**elationships between catch, temperature and rainfall (monthly, seasonal and annual) were explored using single linear regression models and correlation analysis

- **C**atch, effort and rainfall data were entered into the CLIMPROD program to generate a simple surplus production model

Barramundi catch - rainfall

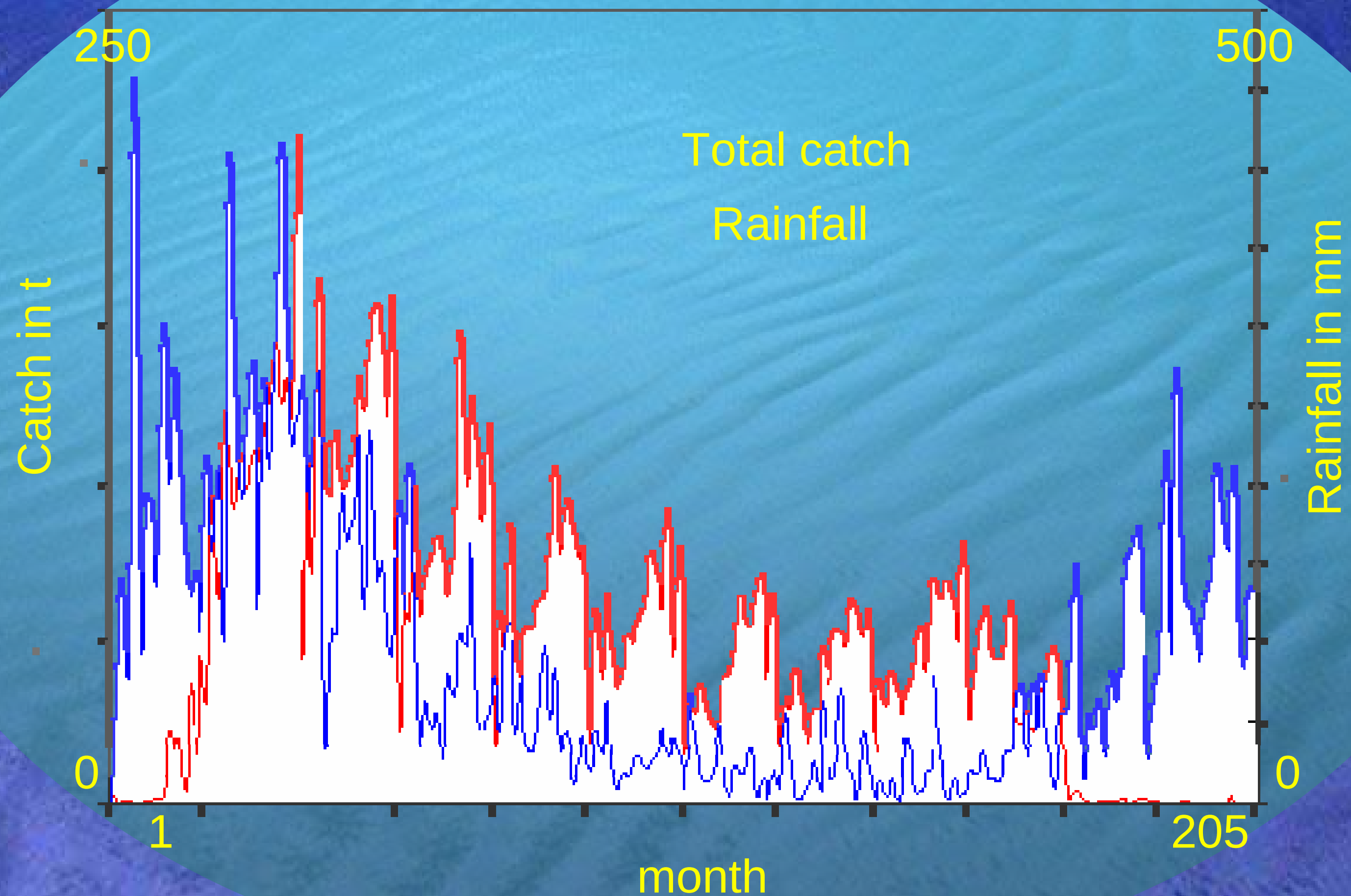
Intro

Climate

Methods

Results

Summary and Outlook



Intro

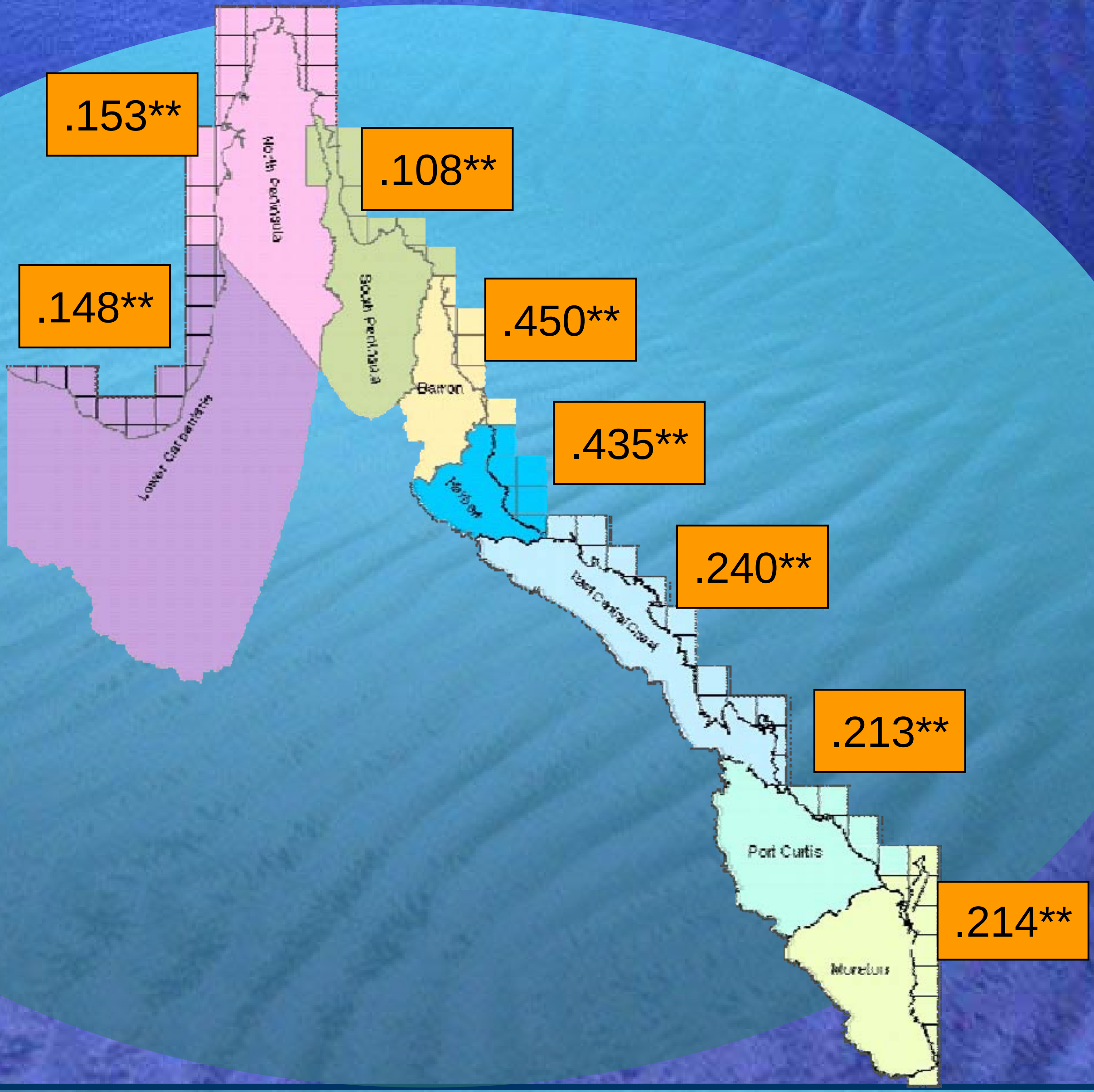
Climate

Methods

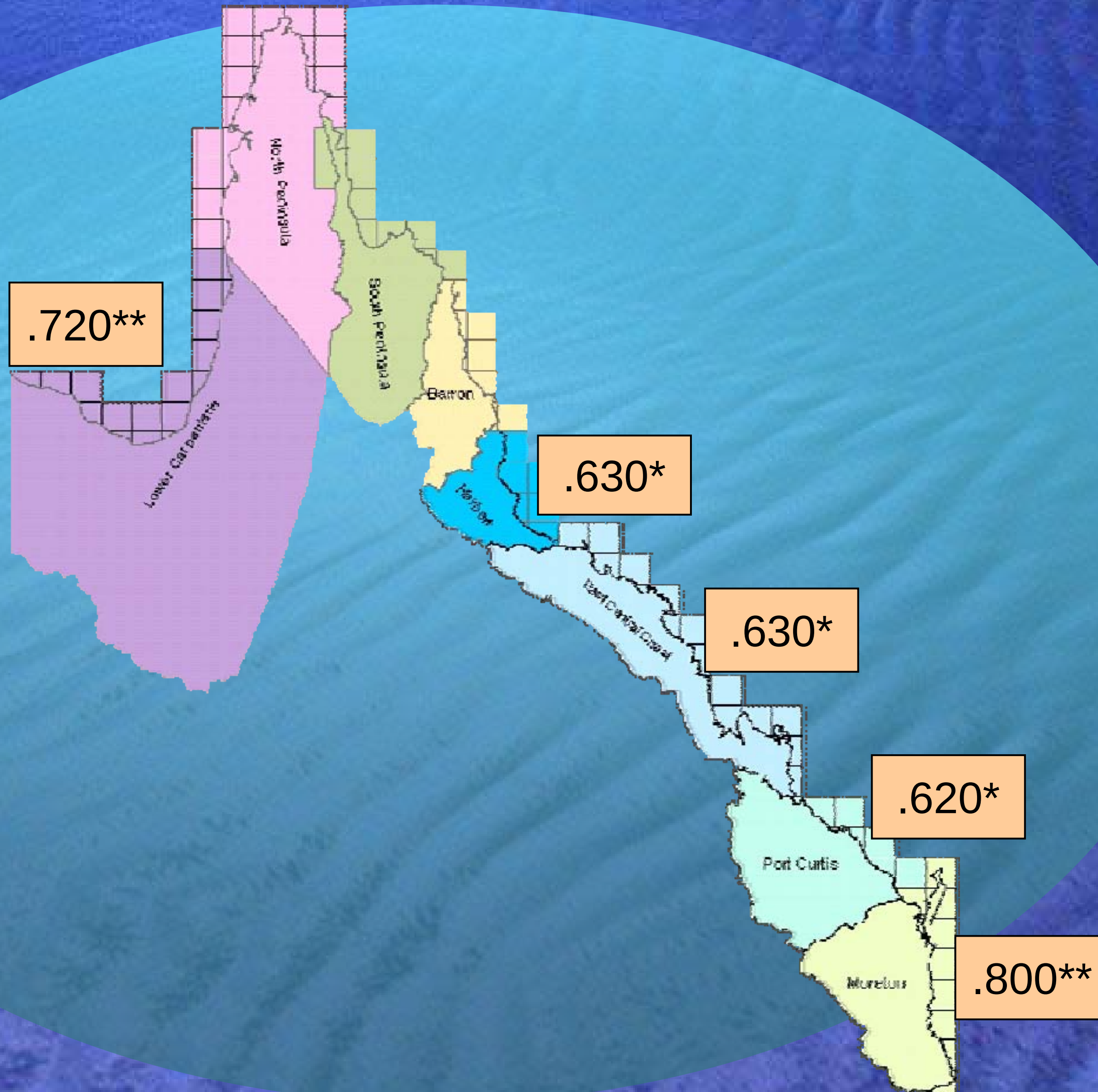
Results

Summary and Outlook

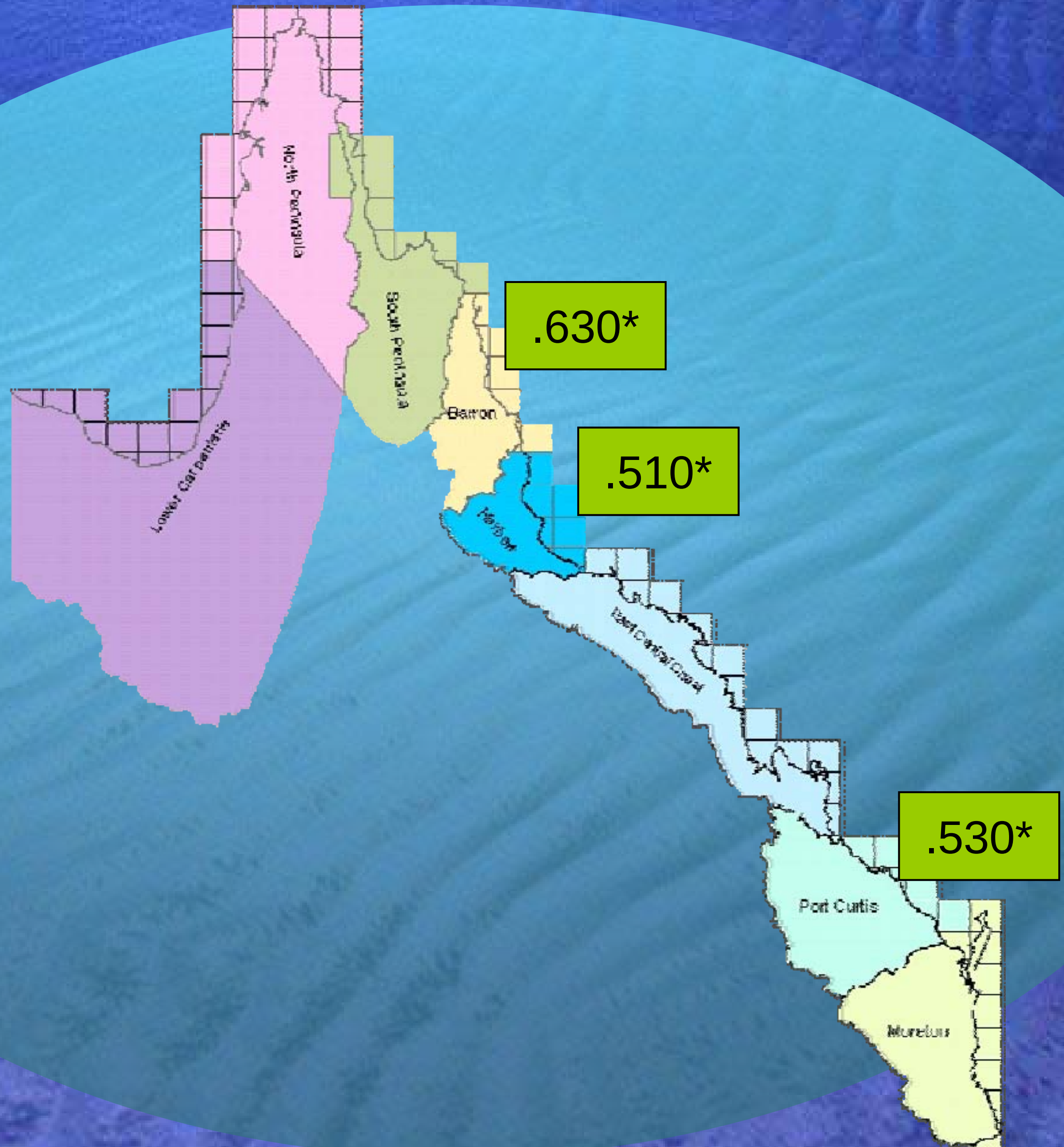
Monthly barramundi catch - rainfall



Seasonal mud crab catch - rainfall



Annual tiger prawn catch - rainfall



Annual mullet catch - rainfall

Intro
Climate
Methods
Results
Summary and Outlook

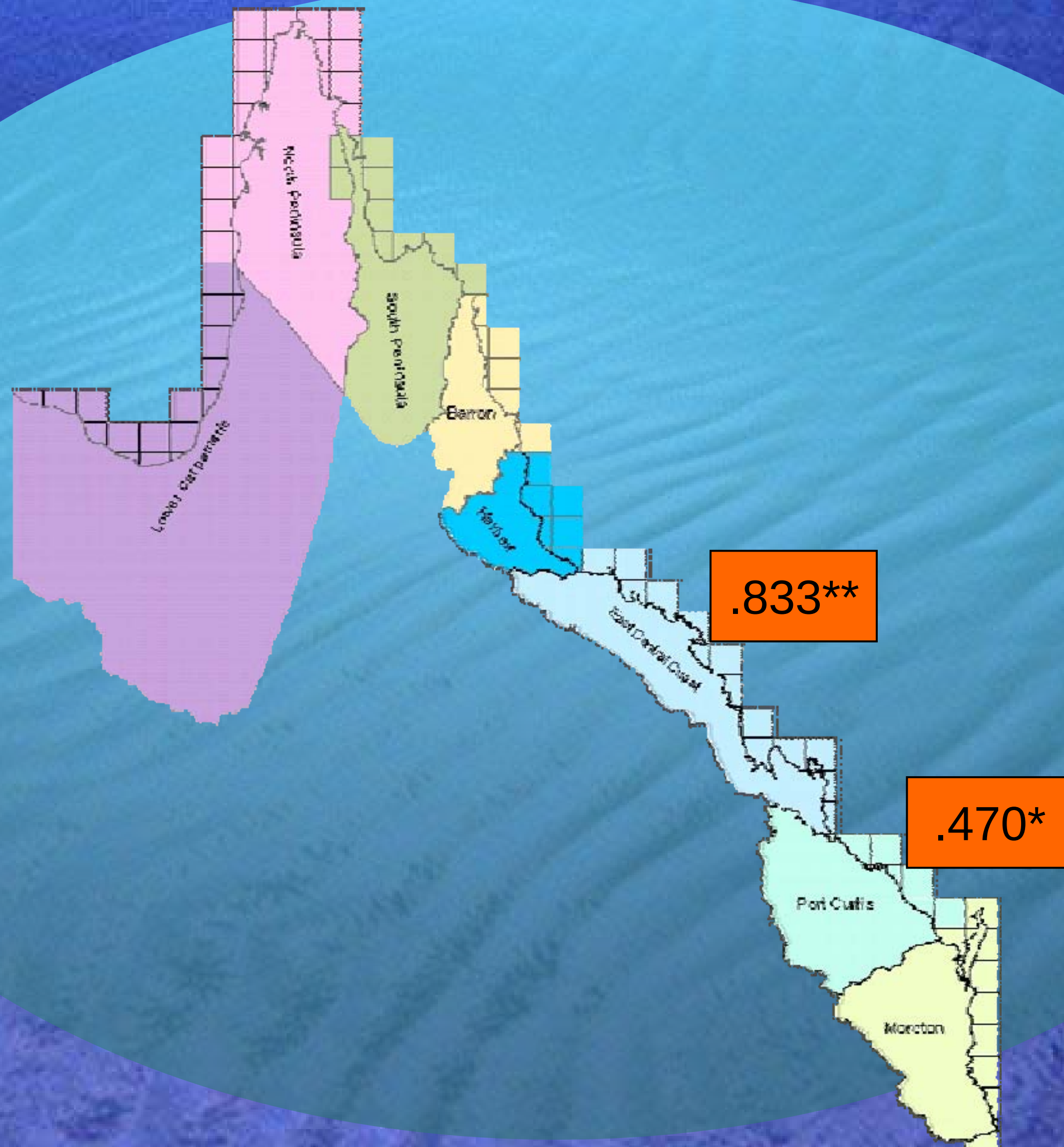
Intro
Climate
Methods
Results
Summary and Outlook

CLIMPROD model

Species	r^2	MSY in t (+ SE)	CPUE model	Modification
Barramundi East coast [a; c]	0.93	246 (±40)	$aV^b \exp(EcV^d)$	Age at recruit. 4yr
Mullet [a; c]	0.75	2076 (±101)	$a + bV + cV^2 + dE$	Age at recruit. 3yr
Mud Crab [b; c]	0.87	221 (±63)	$a + bV + cE$	Exploited year classes 3
King Prawn [b; c]	0.41	3176 (±281)	$(a + bE)^{(1/c-1)}$	Exploited year classes 3
Tiger Prawn [b; c]	0.61	2464 (±313)	$(a + bV) \exp(cE)$	Age at recruit. 1yr

Intro
Climate
Methods
Results
Summary and Outlook

Annual barramundi catch - temperature



Intro
Climate
Methods
Results
Summary and Outlook

Monthly mud crab catch – temperature

Monthly tiger prawn catch - temperature

Intro

Climate

Methods

Results

Summary and Outlook

Intro

Climate

Methods

Results

Summary and Outlook

Annual mullet catch - temperature

Intro
Climate
Methods
Results
Summary and Outlook

Summary - temperature

- **M**onthly and yearly average temperatures were related to prawn, mud crab, barramundi and mullet catch for which higher monthly air temperature resulted in higher catch rates in south-east Queensland
- **S**hift from positive temperature effects towards a negative relationship for the northern regions
- **L**imited temperature data for a number of stations and significant differences between air and water temperature analyses are therefore somehow compromised

Summary - rainfall

- **R**egional differences in the rainfall–catch relationship were significant

- **W**etter periods between May and August may stimulate the migration of mullet and higher river flow stimulates the downstream movement of mud crabs

- **L**agged effect of river flow on barramundi catches due to enhanced productivity and increased survival and/or growth of the juvenile stages

-> positive effects of rainfall (e.g., availability of food) or negative effects (e.g., higher mortality)

Outlook

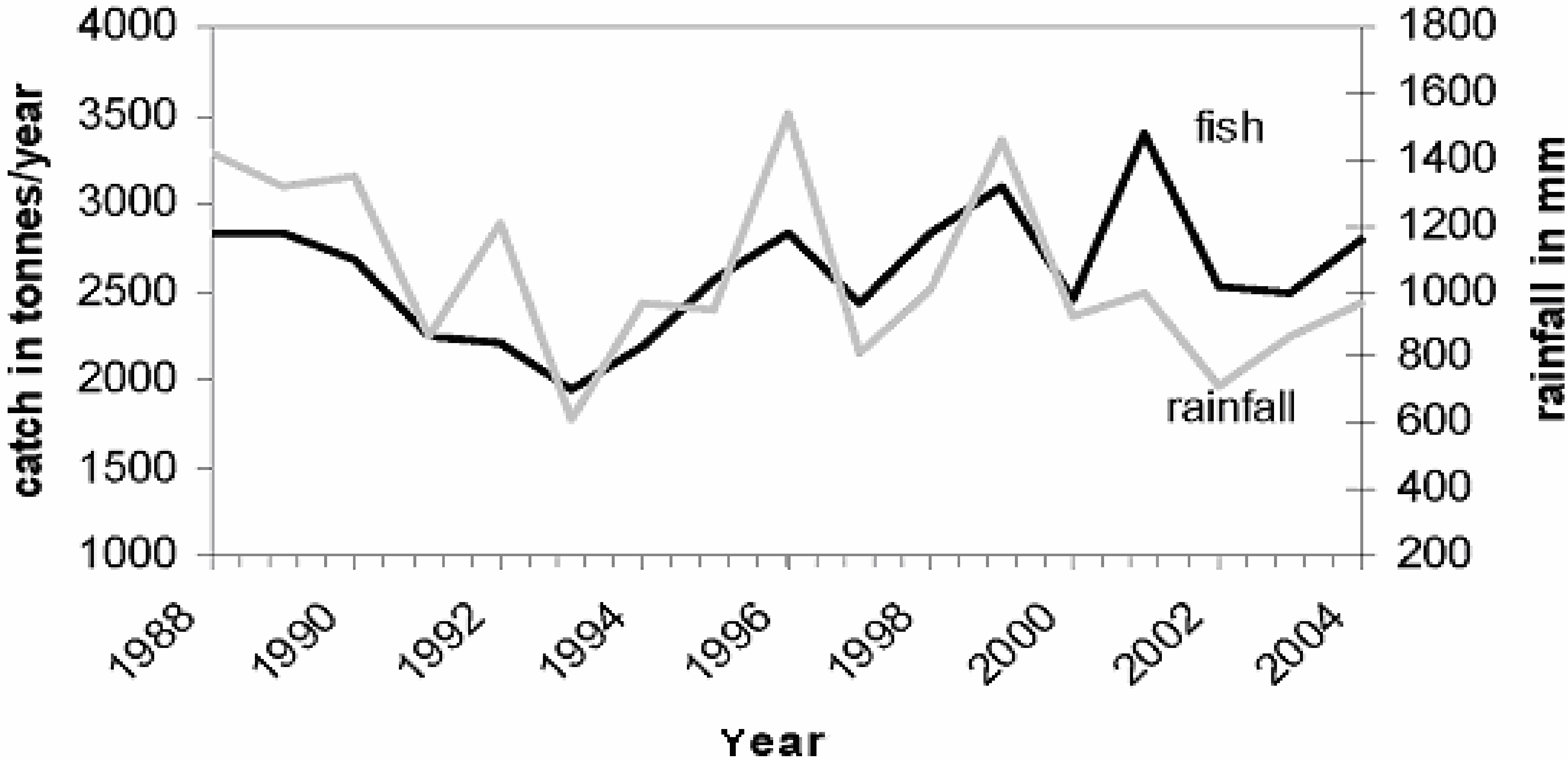
Outlook

- Investigating relationships between mud crabs and rainfall for a number of states in Australia
- Incorporation into bioeconomic models
- Identify a more comprehensive management policy that will ensure sustainability even under conditions of higher environmental pressure, e.g., a reduction of rainfall

Acknowledgment

I like to thank the Department for Primary Industries and Fisheries and the Bureau of Meteorology for providing fish and climate data

Michael Arthur, Joe Lee, Norm Duke, Jan Warnken, Leonard Olyott,, Karen Danaher, Julie Robins for ideas, support and comments during this project



There are temperature threshold limits for crustacean zoea and megalopa larval stages. Staples and Heales (1991) found the lowest survival rates of juvenile *P. merguiensis* at high temperature (30°C) and low salinity (< 10 ppt).