

# ADVANCING AQUACULTURE IN ROCKHAMPTON

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# INTRODUCTIONS

**WADE CLARK – PROJECT MANAGER**

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# OPENING

**MAYOR MARGARET STRELOW**

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# AGENDA

Aquaculture Development Areas Overview

Seafood Industry Overview

Aquaculture Industry Overview

Aquaculture Opportunities – Supply Chain Development

Best practice examples:

- Case study examples

- Leading technologies – managing discharge – water improvement

Bajool & Marmor Aquaculture Development Area – key considerations and opportunities

Rockhampton Aquaculture Industry Development Plan and next steps



# AQUACULTURE DEVELOPMENT AREAS

**Stephen Smith – Department of Agriculture & Fisheries**

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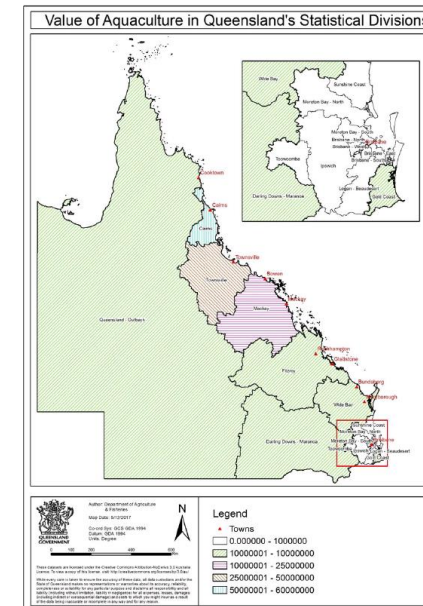






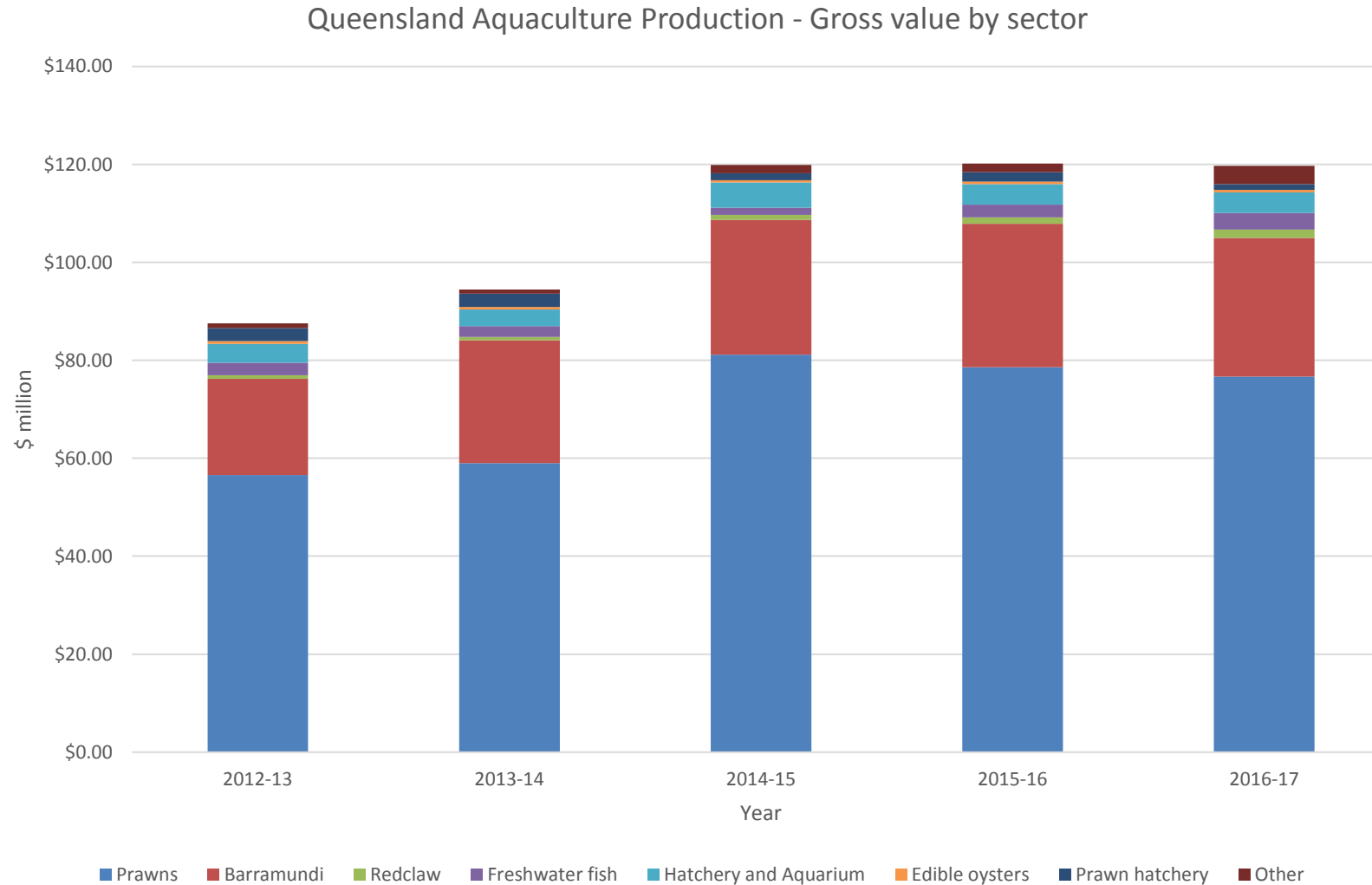
# Current status of aquaculture in Queensland

- Value of the aquaculture industry in 2016-17 was \$119.7 million
- Total production in 2016-17 was 7869 tonnes
- Predominately land-based aquaculture
- Currently no cage culture operations
- The most valuable sectors are:
  - prawns (4264t, \$77.8M in 2016-17), and
  - barramundi (2987t, \$28.4M in 2016-17)
- Directly employs 533 full-time equivalents
  - 55% in the prawn farming sector
- Majority of production is from central and north Queensland
  - overall, the Fitzroy statistical division (incl. Rockhampton) produced 99.9 tonnes, at a value of \$1.7M.





# Current status of aquaculture in Queensland



# Review of Aquaculture Regulation in Queensland

## Challenges

- Regulatory framework with complex licensing requirements
- Limited areas available for suitable land-based marine aquaculture – e.g. operational, environmental or planning constraints for aquaculture development on coastal land, conflicting land use e.g. high degree of difficulty with uncertainty over approvals, high cap ex, high op ex = high risk
- The previous government directed the Queensland Competition Authority (QCA) to investigate and report on the regulation of Queensland's aquaculture industry.



# QCA Final Report on Aquaculture Regulation in Queensland

In 2016, the Queensland Government endorsed key recommendations from the QCA Final Report to facilitate expansion of aquaculture in Queensland while addressing environmental concerns:

- i. **creation of 450ha terrestrial Aquaculture Development Areas (ADAs) suitable for aquaculture operations**
- ii. develop assessment codes  
(regulatory conditions for aquaculture in each ADA)
- iii. provide certainty about the future price and availability of environmental offsets
- iv. investigate the potential for marine aquaculture development areas.

# Overview

- ADAs now recognised in the State Planning Policy mapping, also recognised in State Planning Policy State Interest Agriculture Guideline and on the Business QLD website
- Over 7,000Ha
- 2 of the 3 largest sites in the state are in Fitzroy Central West
- Where are they?



# Rockhampton / Casuarina Creek



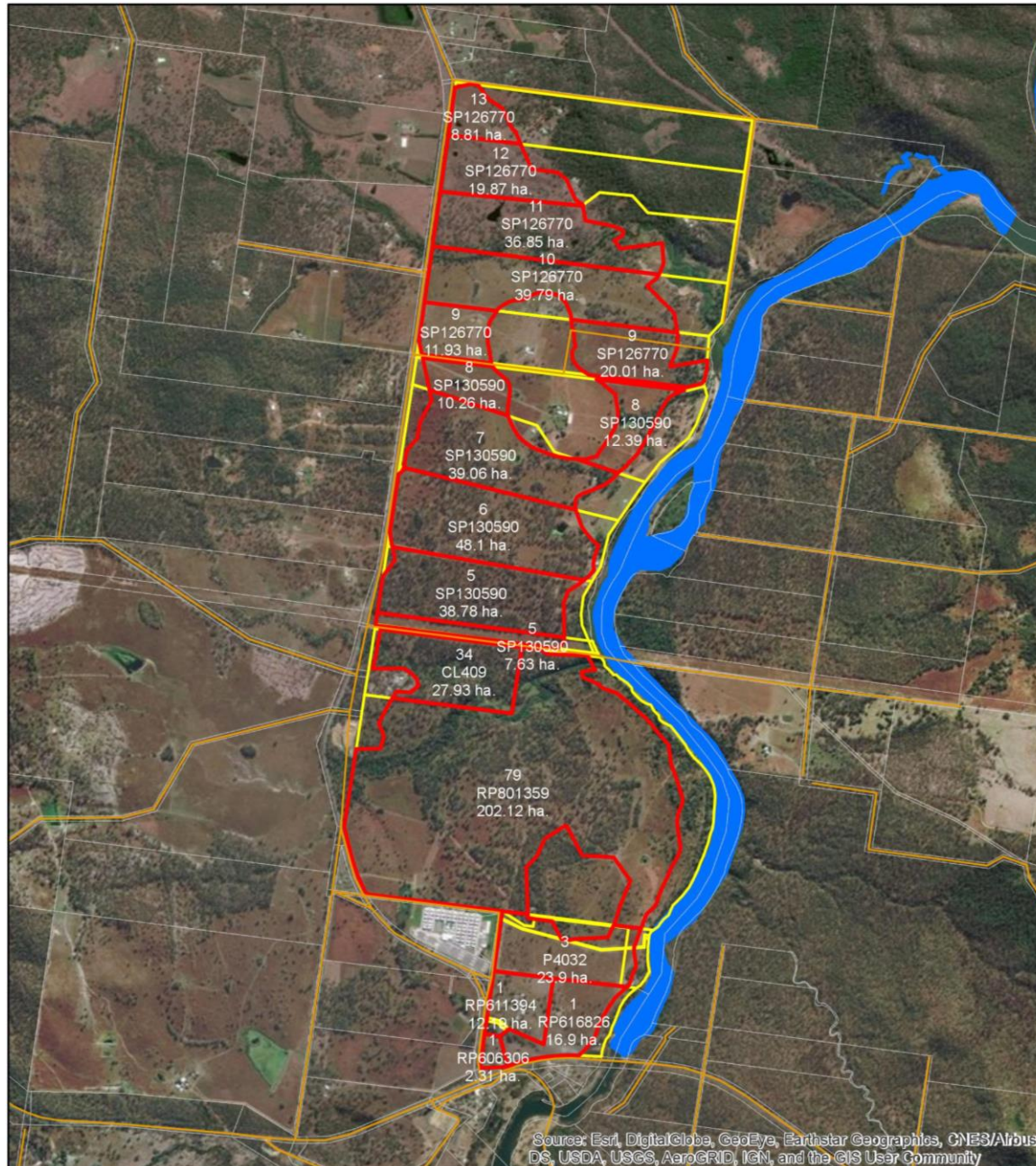


Rockhampton / Raglan Creek





# Gladstone / Calliope River



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



# Where to from here?

- The Initiative has moved on from a Planning perspective to that of Economic Development and Investment Attraction
- 3 important elements
- **1) Landholders**
- **2) Proponents**
- **3) Statutory authorities**

# Landholders

- Provide as much information to landholders as possible.
- Provide re-assurance that this isn't about compulsory acquisition
- This is about opportunities
- Confirm that existing uses can still occur and this in no way reduces the functionality of the land – it is completely the opposite
- Highlight the numerous investment options
- And if interested, seek expressions of interest in engaging with investors

# Proponents

- Actively seek out aquaculture proponents seeking to invest in Queensland
- Define their objectives and to commence business matching with willing landholders
- Provide case management support for engaging with statutory authorities at all levels.

# Statutory Authorities

- State Government and Local government
- Now that the state has defined areas that are ideally suited to aquaculture what would an approval and the conditions look like.
- Pre-defining the model operating conditions for proponents
  - Remove uncertainty
  - Reduce the risk
  - Fast track investment



# An example



- Australia's largest Aquaculture producer Tassal Salmon has now invested in the Queensland Aquaculture Industry
- Through subsidiary De Costi Seafood, their plans are to take production to 3,000 tonnes of Black Tiger Prawns with immediate expansion of their newly acquired site at Proserpine
- \$33 Million Investment. 70 to 100 jobs and Queensland office for operations now established in Proserpine.
- Longer term plans are to take production to 20,000 tonnes all of which is intended for import replacement.
- Putting that in perspective, the entire Queensland industry currently produces approximately 4,000 tonnes.



# Thank you

**Contact:**

**Stephen Smith**  
**Manager: Strategic Projects and Planning**  
**Department of Agriculture and Fisheries.**  
[Stephen.smith@daf.qld.gov.au](mailto:Stephen.smith@daf.qld.gov.au)



# SEAFOOD & AQUACULTURE INDUSTRIES OVERVIEW

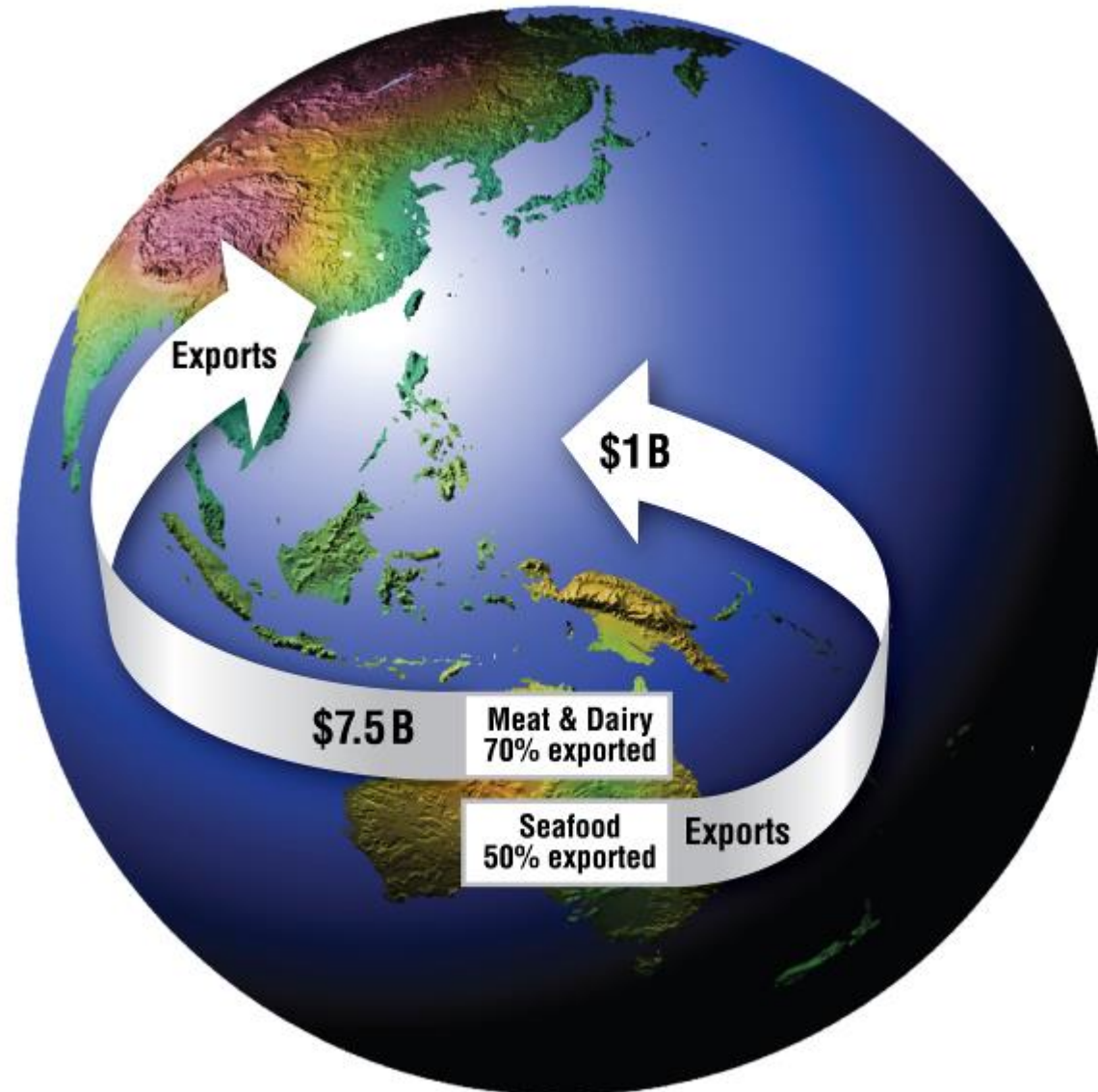
**Dr Mat Cook – Research Director CSIRO Aquaculture Program &  
Rob Bell - Blueshift Consulting**

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# Australian trade in livestock & seafood





# This is familiar to Australians



Image courtesy of Beef CRC



**But this is not (yet)...**

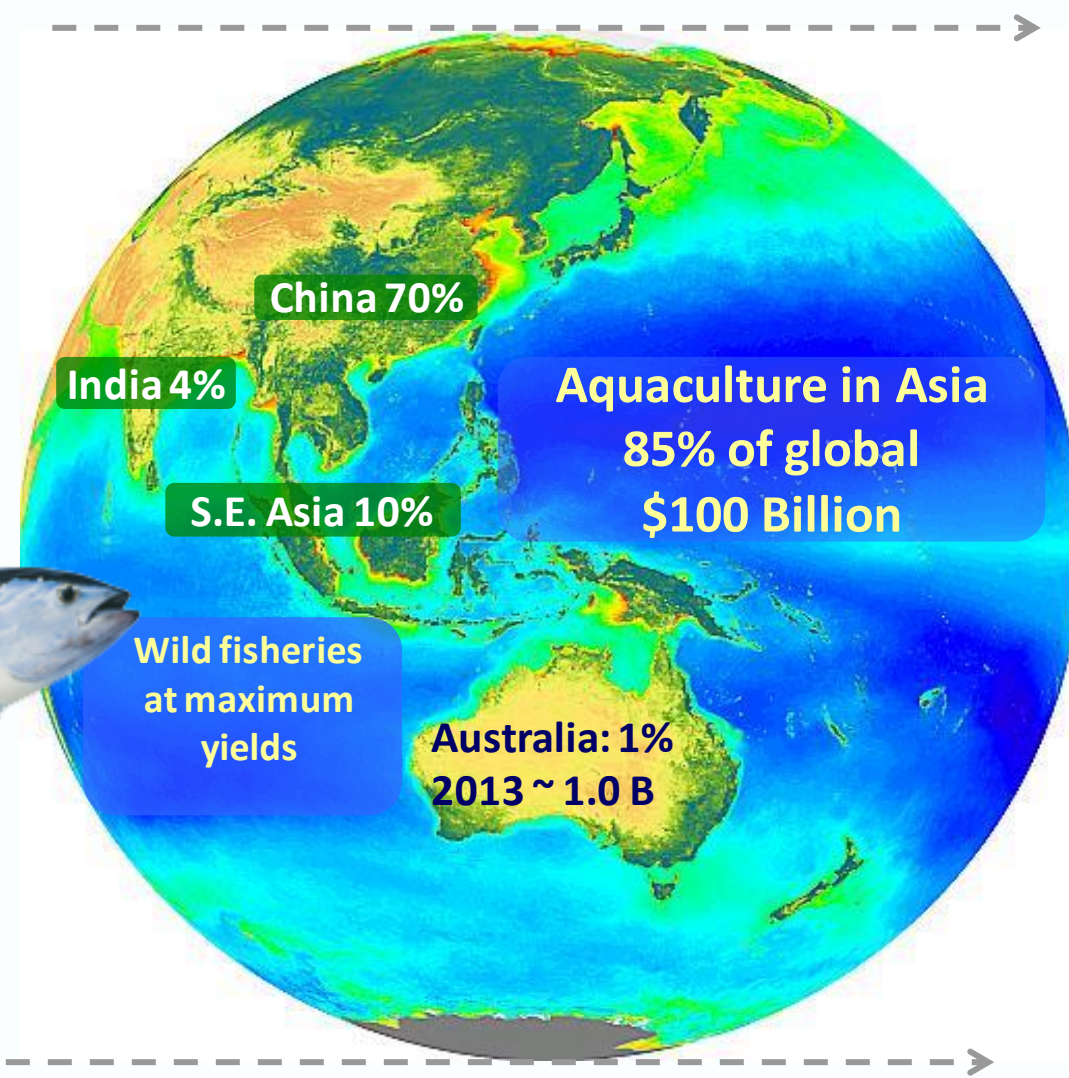


# Mining and aquaculture ?



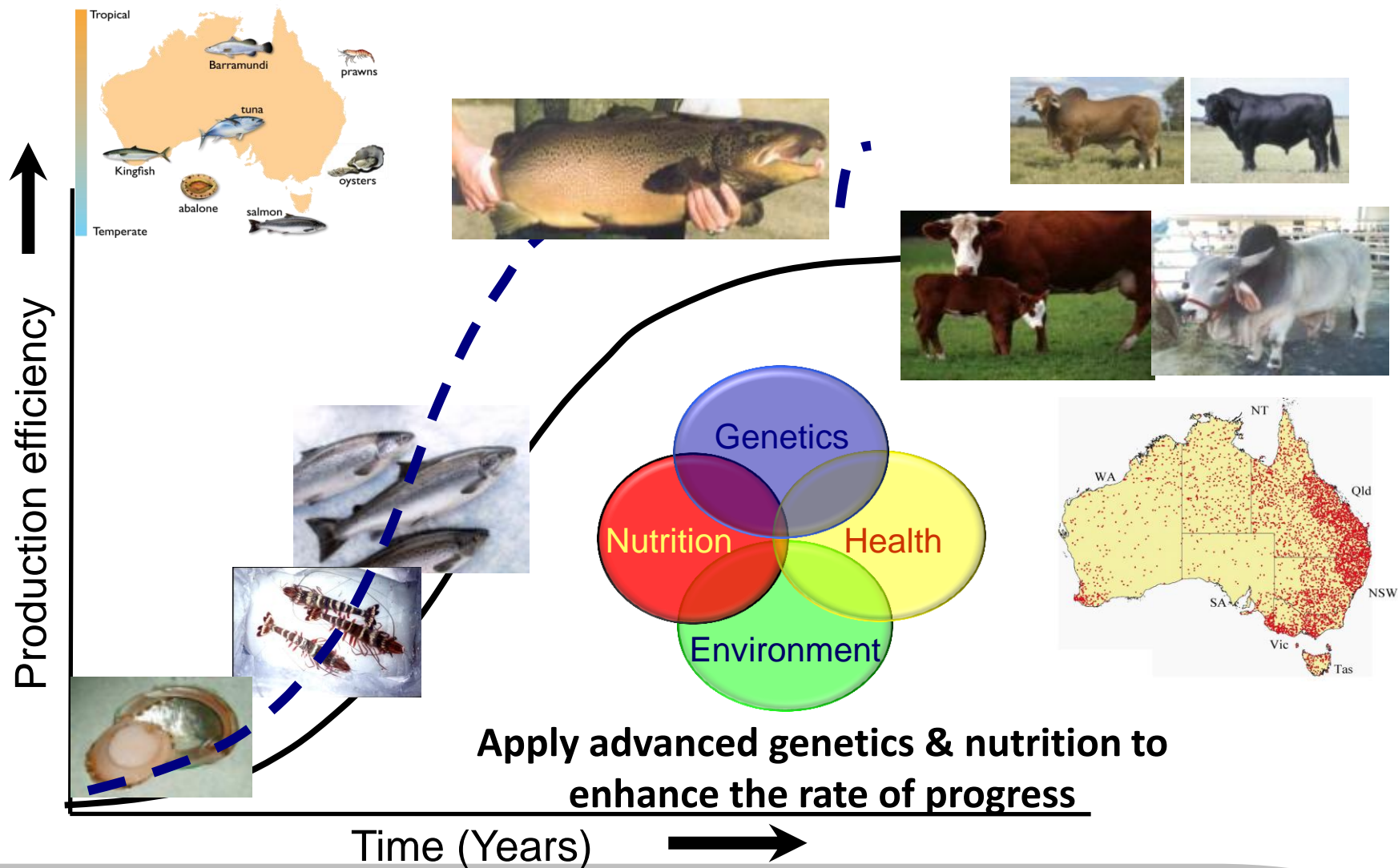


# Aquaculture in our region

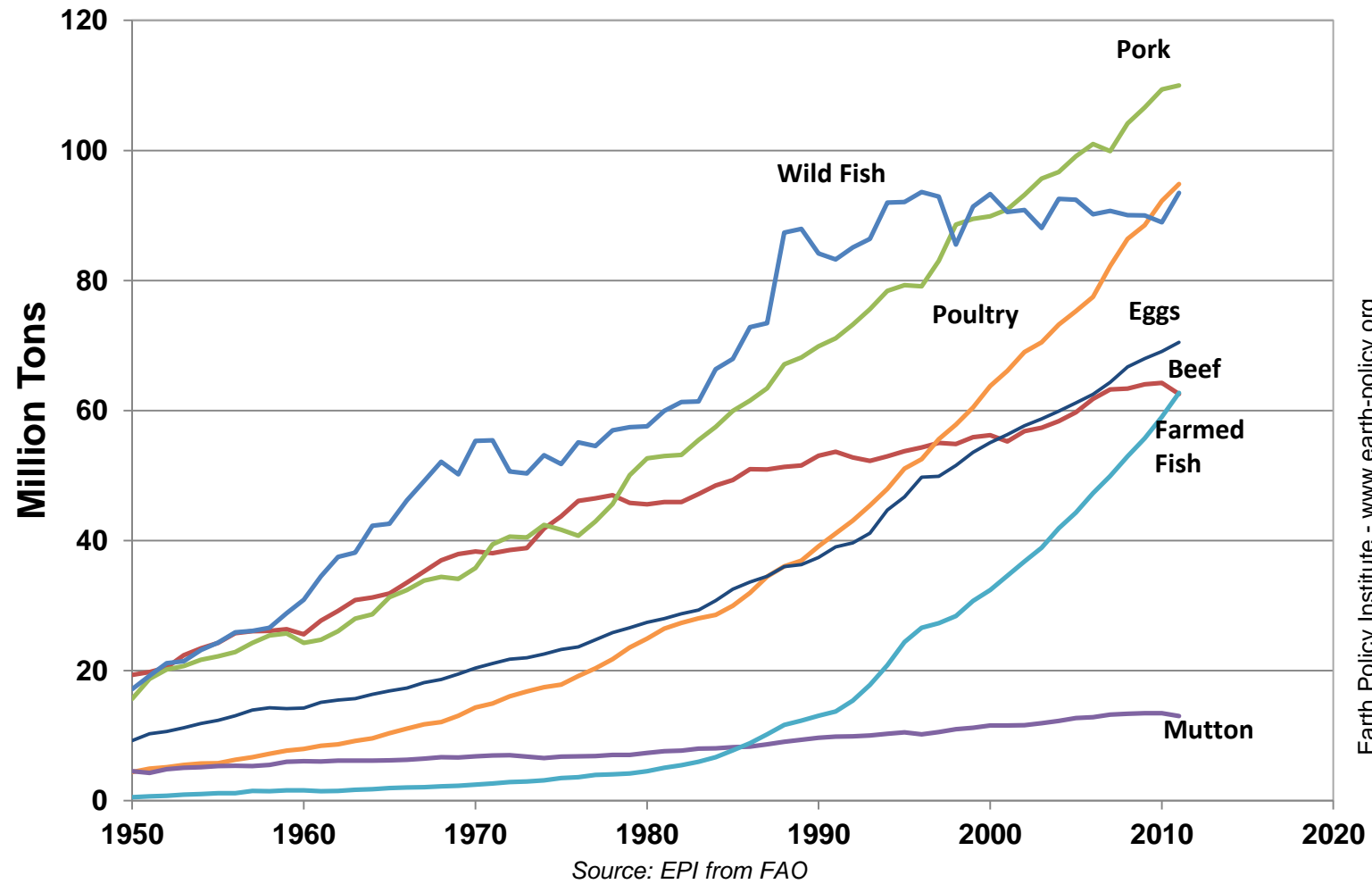




# Comparative maturity of livestock & aquaculture



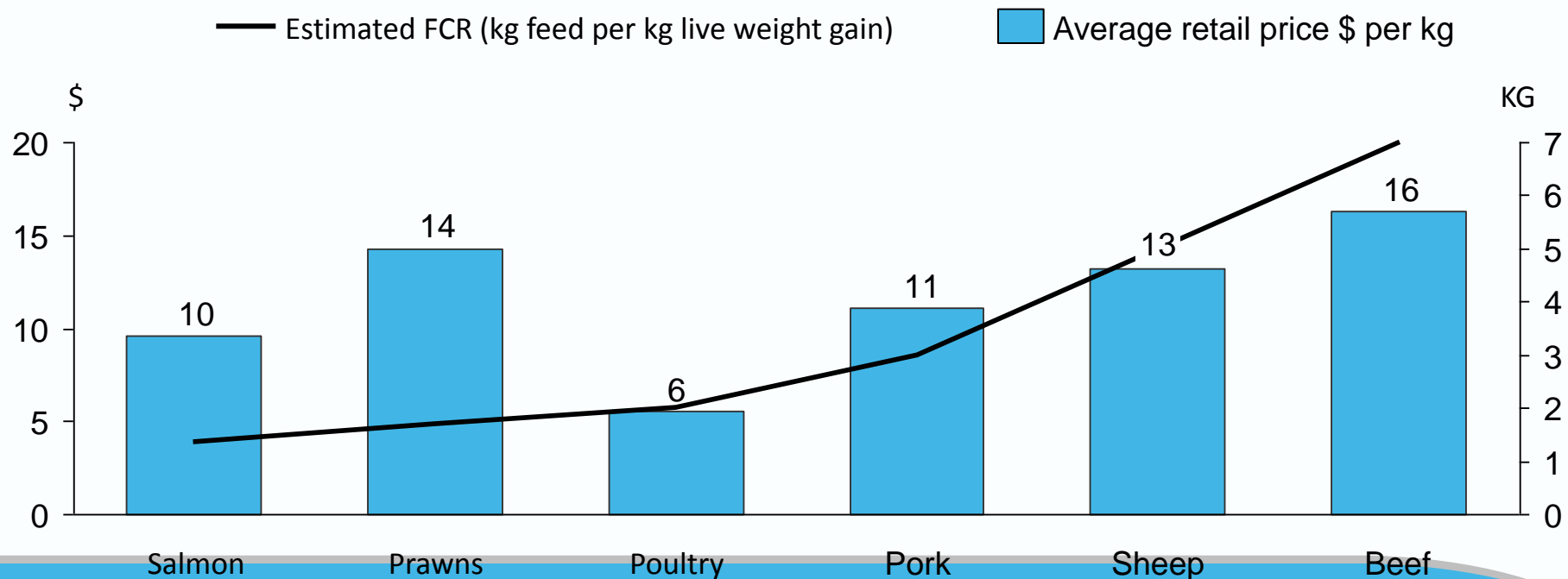
# World Animal Protein Production by Type, 1950-2011



Source: FAO, OECD, ABARES

## Protein FCR and Average Retail Value (\$ per kg)

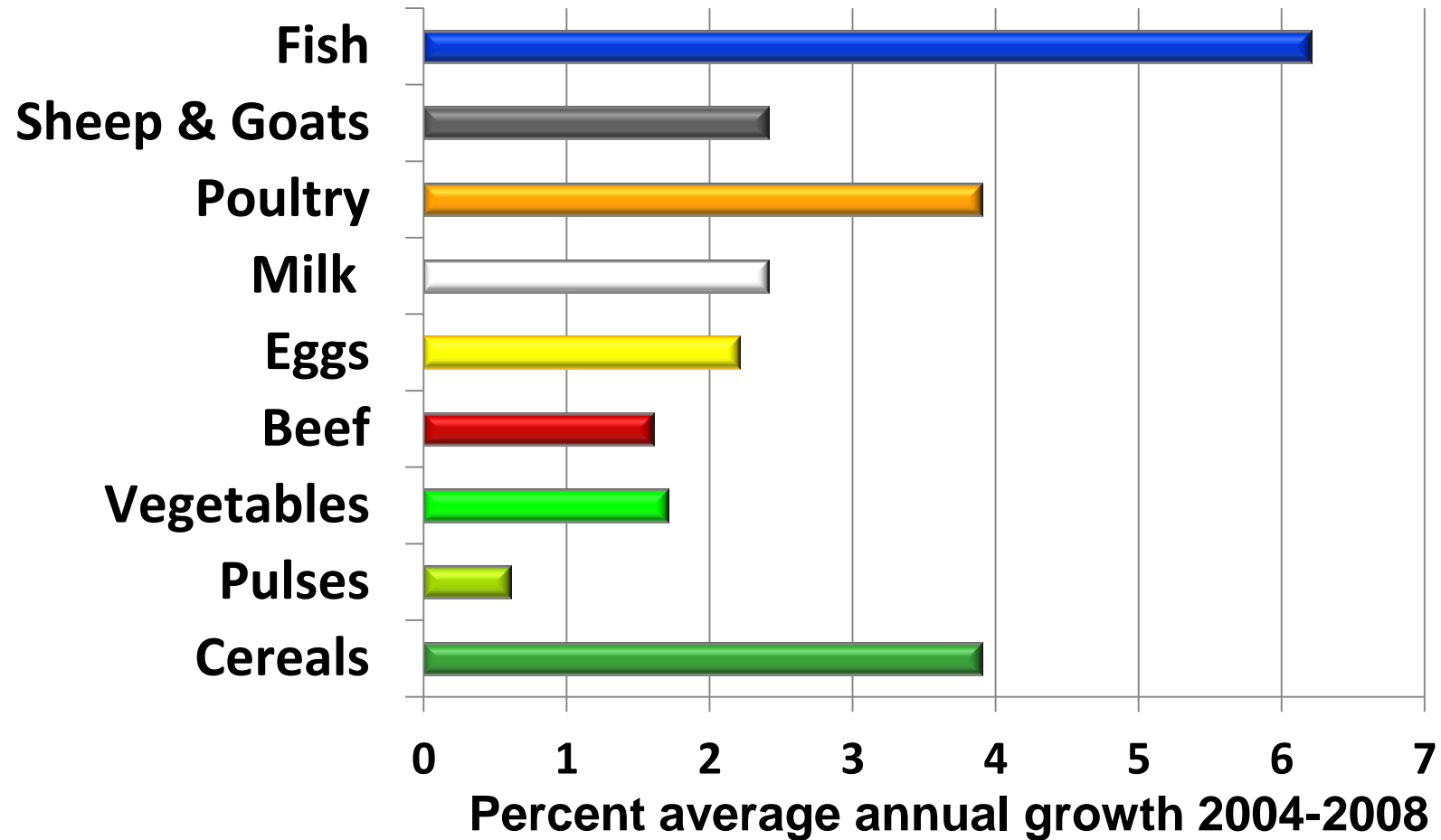
- Fish have high margins available through low FCR and high end market values





# Global aquaculture - sustained dynamic growth

Aquaculture – responding to global demand for animal protein



# Australia sits at the junction of emerging global megatrends...



Global population growth

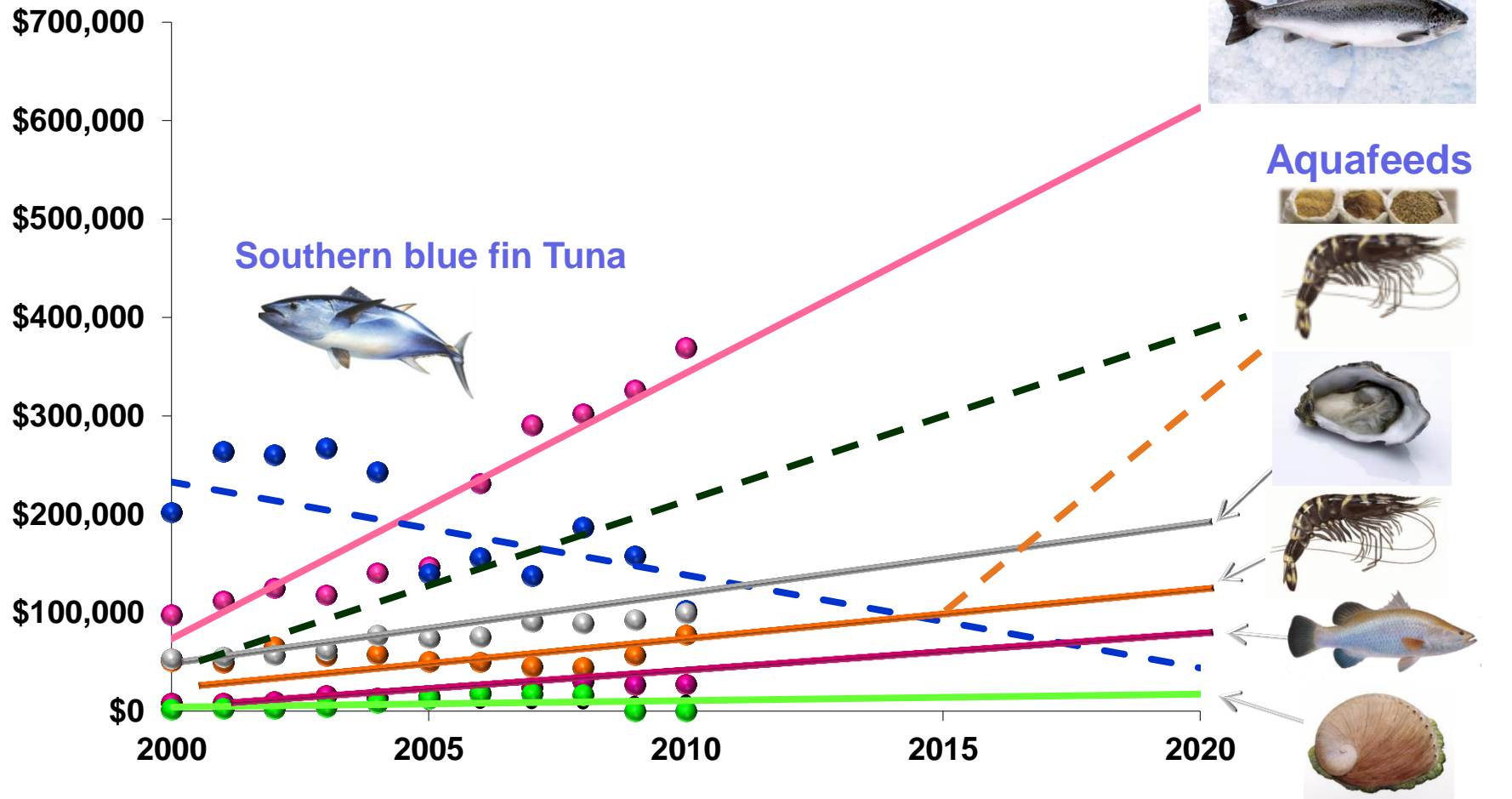
Ecological degradation

Rapid income growth in China



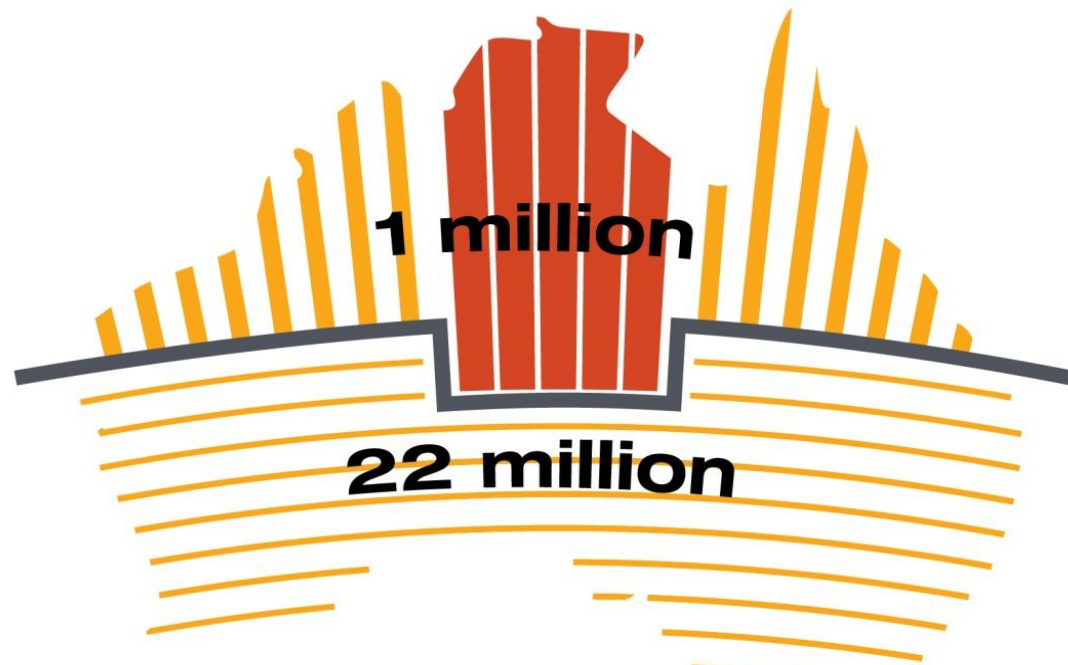
# Australian aquaculture: Value 2010 - 2020

Annual Value (\$'000)



# Aquaculture vision for Northern Australia

200,000 Tonnes of farmed seafood by 2030



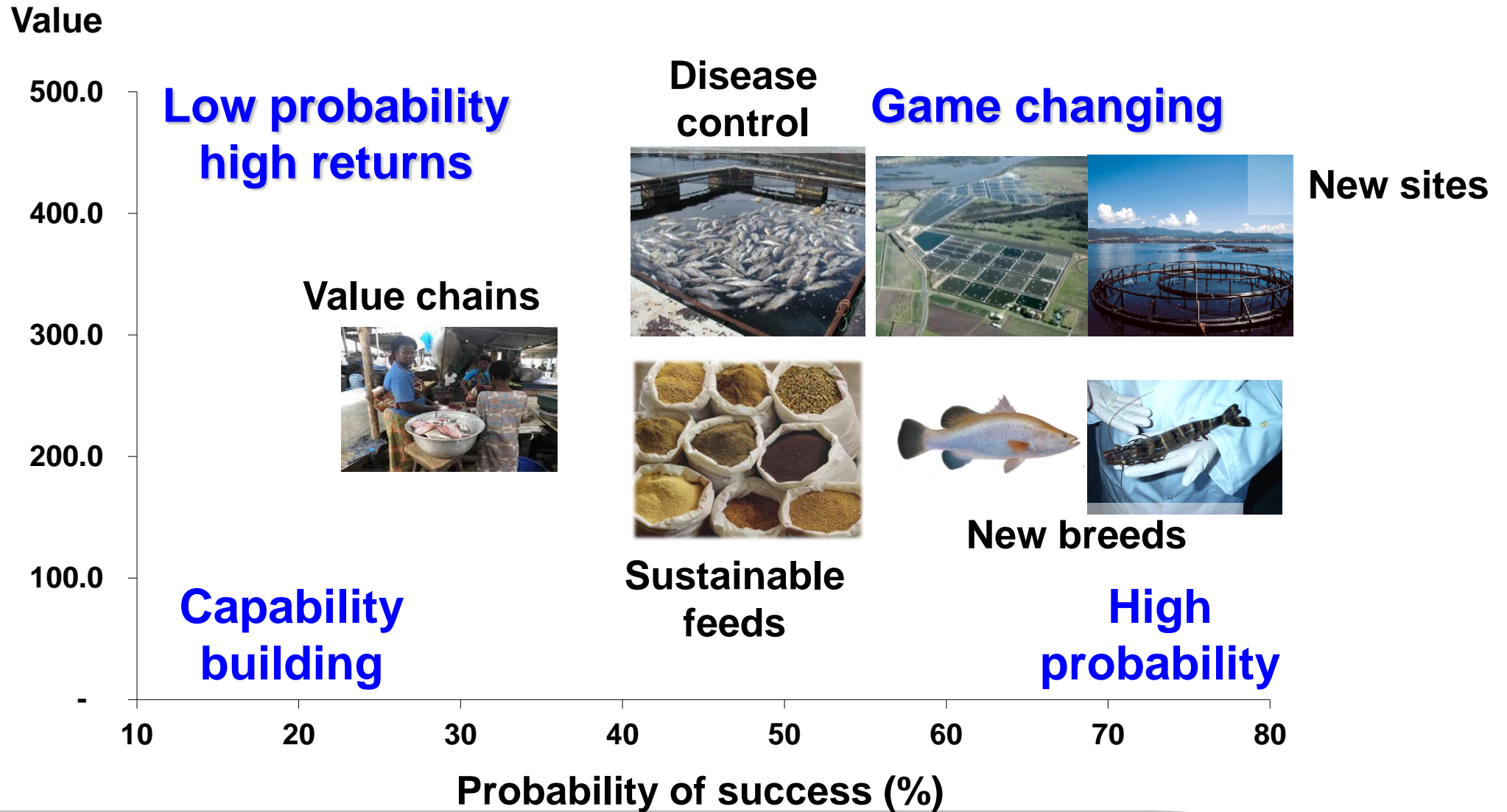
Northern Australia's tropical marine estate is comparable in size to its land area.

And aquaculture will increasingly become a driver of new growth in both coastal and on land operations – Agriculture White Paper 2015

- Drought and flood proof
- Environmentally, socially & economically sustainable
- Scalable
- import replacement
- Export opportunities
- Health benefits to consumers



# Relative impact of options for Northern aquaculture



# The changing landscape of global protein production...

Aquaculture –

fastest growing protein sector for last 30 years

by 2020 > 80 Mtpa

Third largest protein industry behind poultry & pork...

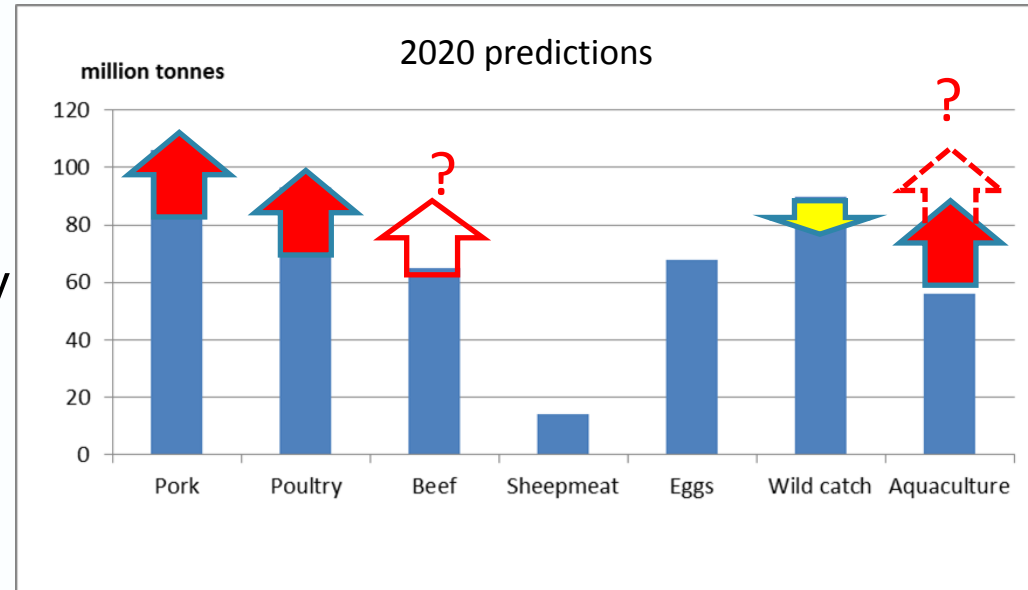
But, well ahead of beef...

By 2020 aquacultured 'white fish' will equal chicken

...then surpass it.

Chinese aquaculture production already equals poultry...

(Source: FAO 2011)



Beef dominates...and Fisheries (total) is 10<sup>th</sup> in production and export values

Potential for aquaculture growth largely ignored by Australian agri-economists and industry...

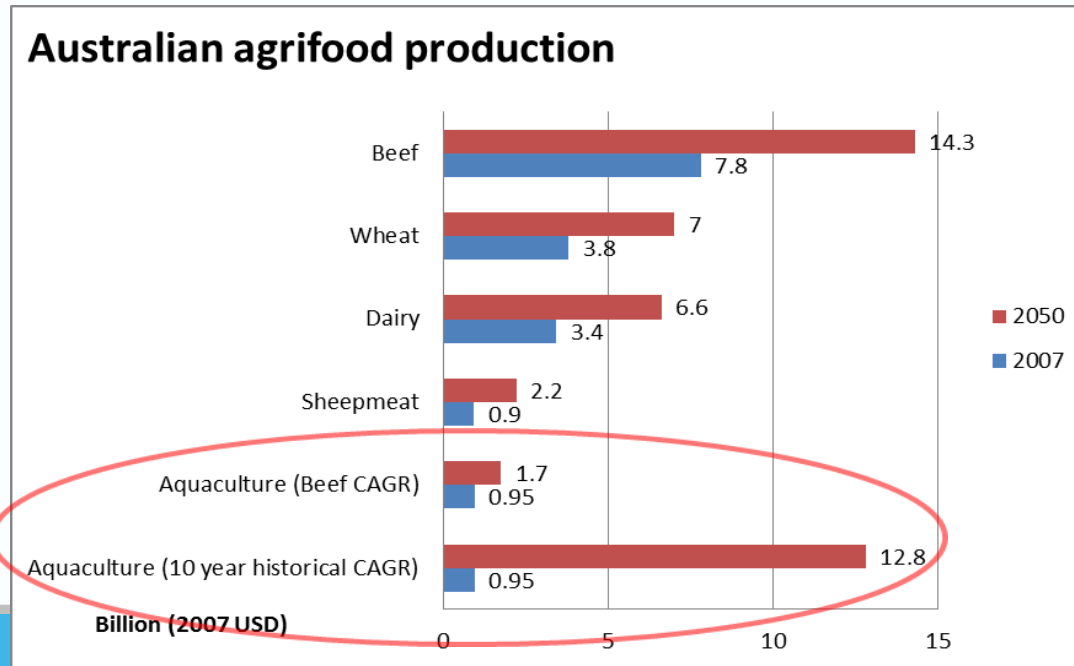
- Aquaculture not regarded as 'farming'...

But...if aquaculture keeps growing at current rate...

- 2<sup>nd</sup> largest agrifood export by 2050 (\$12.8 billion)

Forecast growth (based on historical growth rates) projects aquaculture production at:

- 1.4% growth (forecast beef growth) **\$1.7b** in 2050
- 6.2% growth (past 10 years actual Australian growth) **\$12.8b** in 2050





Very small by Asian standards

Growth in Australia (4%)

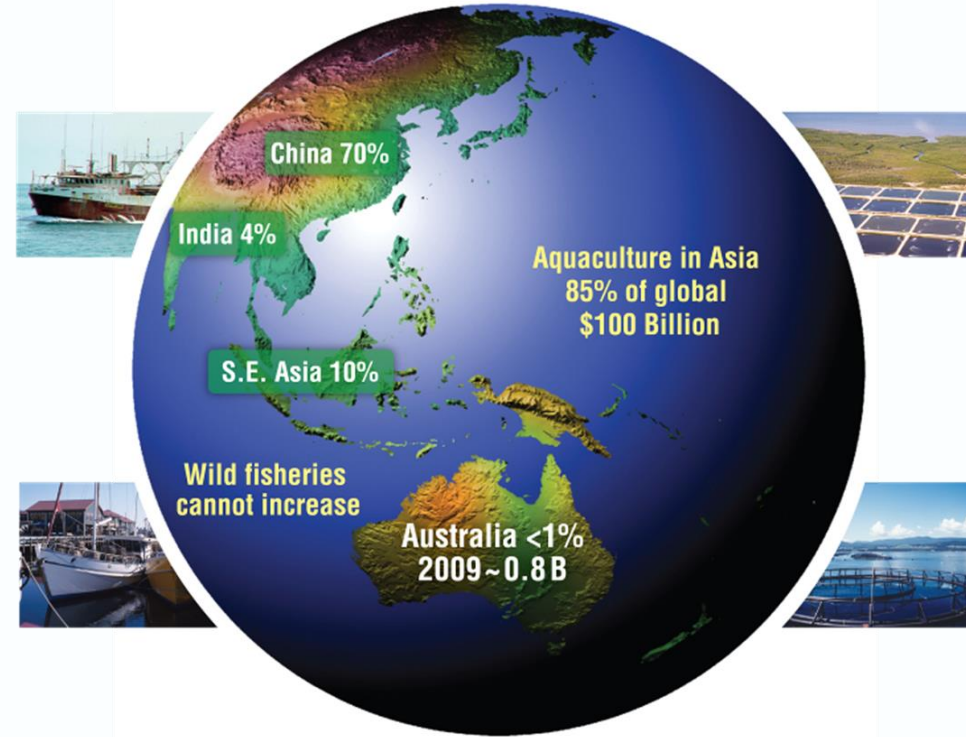
- Australian pond aquaculture for prawns and barramundi very small

...but huge potential

Development mainly restricted to Qld

- subject to very stringent development & discharge conditions
- GBRMPA; Qld EPA
- Qld Competition Authority (QCA) Review

Aquaculture in the region...



# Prawn Aquaculture Industry

[www.csiro.au](http://www.csiro.au)



## Global shrimp production

7 M tonnes total

- 3.9 Mt aquaculture

most important internationally traded fishery commodity (in value)

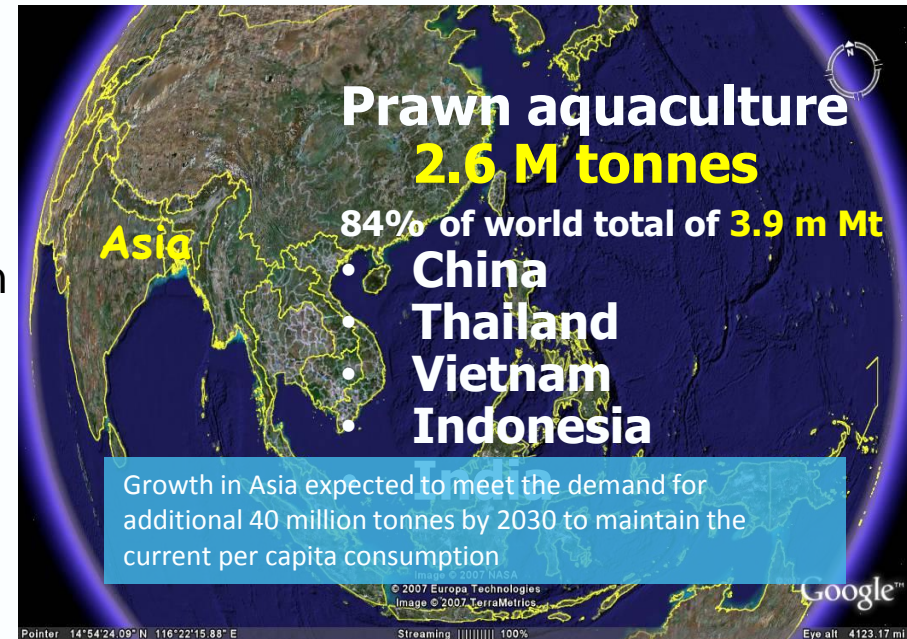
- accounts for 15% of total value of internationally traded fishery products
- top selling seafood item in many countries
  - in USA – 33% of all supermarket seafood sales
- Top seafood consumed on per-capita basis

Sell at a price premium

- More expensive than most other animal protein

One of the most advanced aquaculture sectors...

farmed shrimp constitutes 15% of value of all internationally traded fishery products



Australian total prawn production

~26,000 tonnes pa (\$320M)

1/100<sup>th</sup> of China's aquacultured prawn production

> 70% of Australia's prawn production – wild catch (Qld & NT)

20% (5,200 t) from aquaculture (\$75M) – mostly Qld



# Queensland Prawn Aquaculture – current status...

- Monodon is the predominant species farmed in Australia since (comm. 1980's)
  - However, production volume in Australia (< 5,000 tpa ) ranks outside the world's top 20
  - very small c.f. Vietnam (220,000 tpa), Indonesia (130,000 tpa) and India (80,000).
- There are 79 prawn aquaculture licences issued in Queensland, 34 of which are 'active', with more than half 'dormant', including some significant capacity licences. Prior to the recent approval of the Pacific Reef Fisheries Guthalungra project in 2017, no new licences were issued in the prior 15 years.
- In FY 2017 - 21 'producing' farms operating ~ 550 hectares of growout ponds. Active farms are distributed broadly, across 4 regions in Queensland and one in northern NSW.
  - Gold Coast – between Southport and Brisbane (6)
  - Fraser Coast – between Brisbane and Mackay (4)
  - Whitsunday/Mackay – between Mackay and Townsville (9)
  - North Queensland – Townsville and Port Douglas (15)

## Association & Industry Snapshot



AUSTRALIAN  
**Prawn  
Farmers**  
ASSOCIATION

- ❑ APFA was established in 1993 and is committed to assisting prawn farmers' efforts to be prepared for risks, innovative, profitable, competitive and world leaders in the global prawn industry.
- ❑ 2015-16 total prawn aquaculture \$86.4M (4300 tonnes)
- ❑ Provide more than 300 direct jobs – mostly regional and in Queensland
- ❑ One of the smaller volumetric producers but leads the world in productivity for farmed tiger and banana prawns
- ❑ Sustainable food source high in protein, carbohydrate-free, low in fat and high in omega 3

## Industry Snapshot (cont.)



AUSTRALIAN  
**Prawn  
Farmers**  
ASSOCIATION

- ❑ The only sector that has put in place a RD&E levy with the FRDC to promote growth.
- ❑ Over the next 5 years, significant expansion with a number of key expansion projects already government approved with estimated regional job growth of 500.
- ❑ It is estimated the sector is expected to recover from the WSD outbreak and impact in 2016-18, and nominally grow 300% above current production to 18,000 - 20,000 tonnes by 2030.

## Industry Snapshot (cont.)

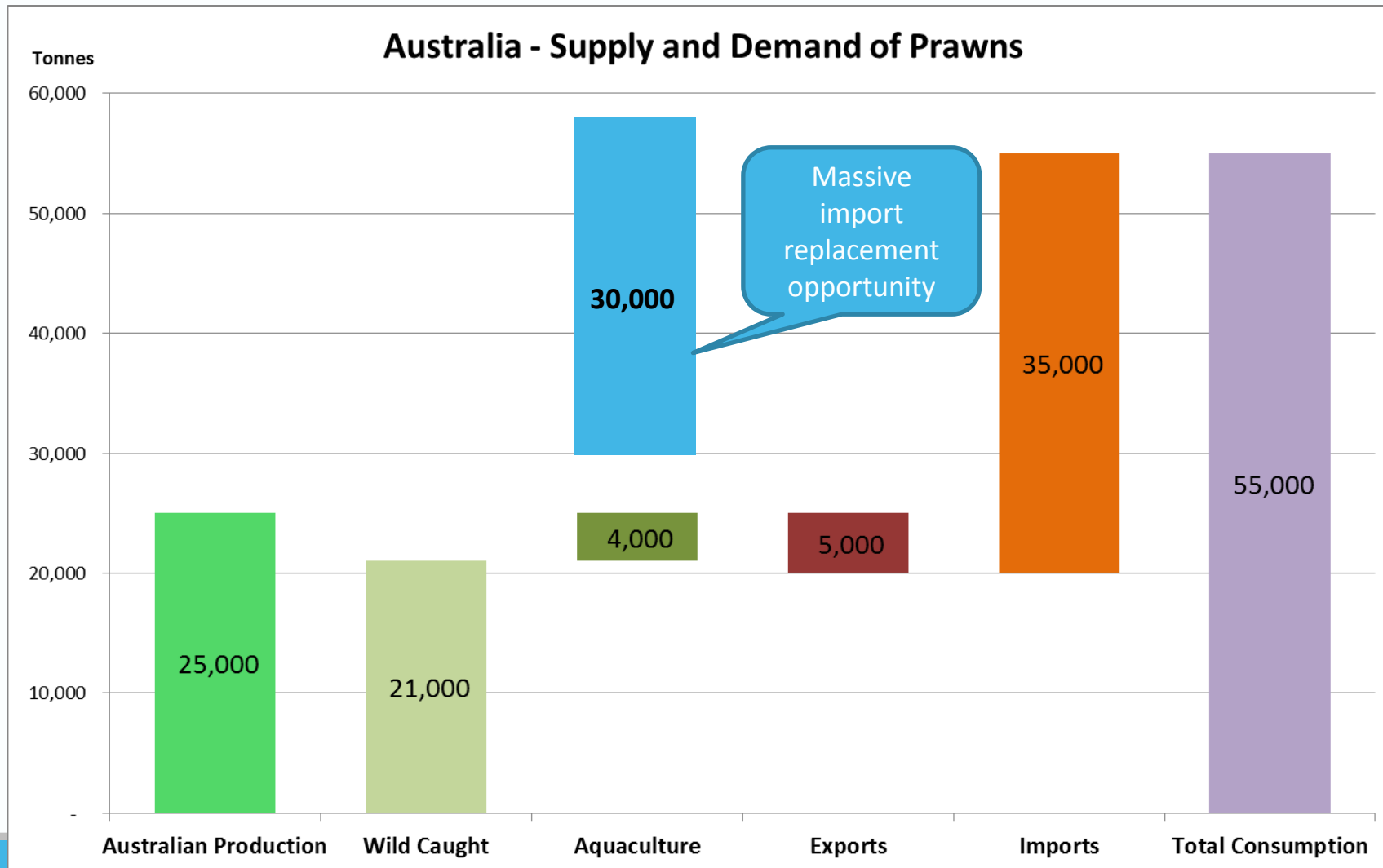


AUSTRALIAN  
**Prawn  
Farmers**  
ASSOCIATION

- ❑ Industry projection of commercial farm harvest to 2022:
  - ❑ 2017 actual 4,657 tonnage
  - ❑ Estimated 2018 4,624 tonnage
  - ❑ Estimated 2019 5,926 tonnage
  - ❑ Estimated 2020 7,336 tonnage
  - ❑ Estimated 2021 9,884 tonnage
  - ❑ Estimated 2022 13,479 tonnage



# Domestic Market Opportunity...?



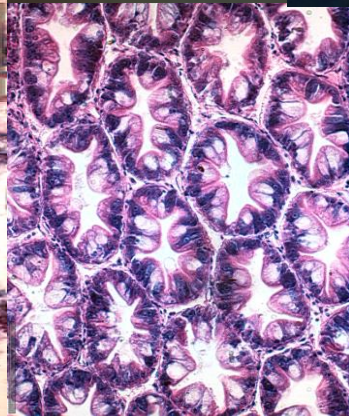
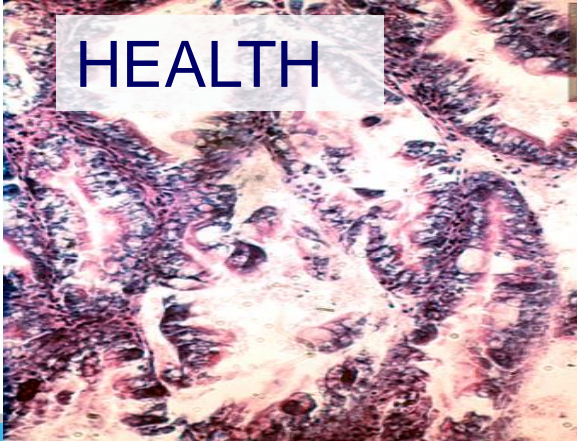
# Realising the benefits of Domestication and Breeding

# Selective breeding of *Penaeus monodon*

GROWTH



HEALTH



QUALITY



## Short term (1-4 yr)

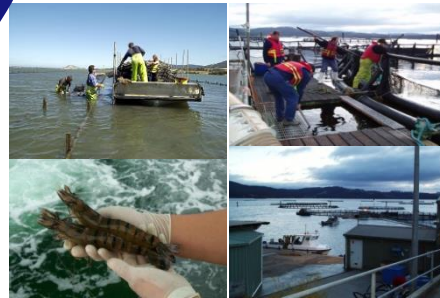
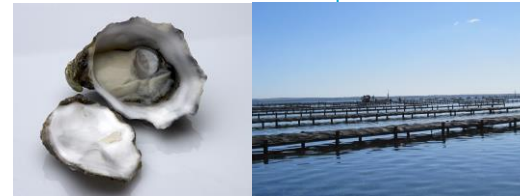
### Domestication & founder stock selection

- Molecular markers
- Genetic diversity
- Disease diagnostics
- Health status
- Database



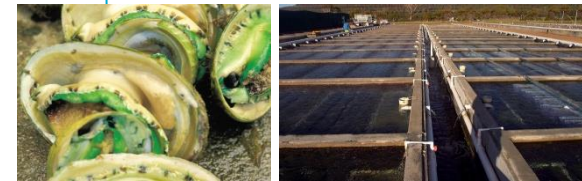
## Medium (Years 5-10)

### Selected genotypes stocked on farm



## Long term (10-20)

Cumulative genetic gains to increase value of Australian industry by \$400 M by 2020



Founder stocks

Pilot breeding

Commercial breeding

Scale up breeding

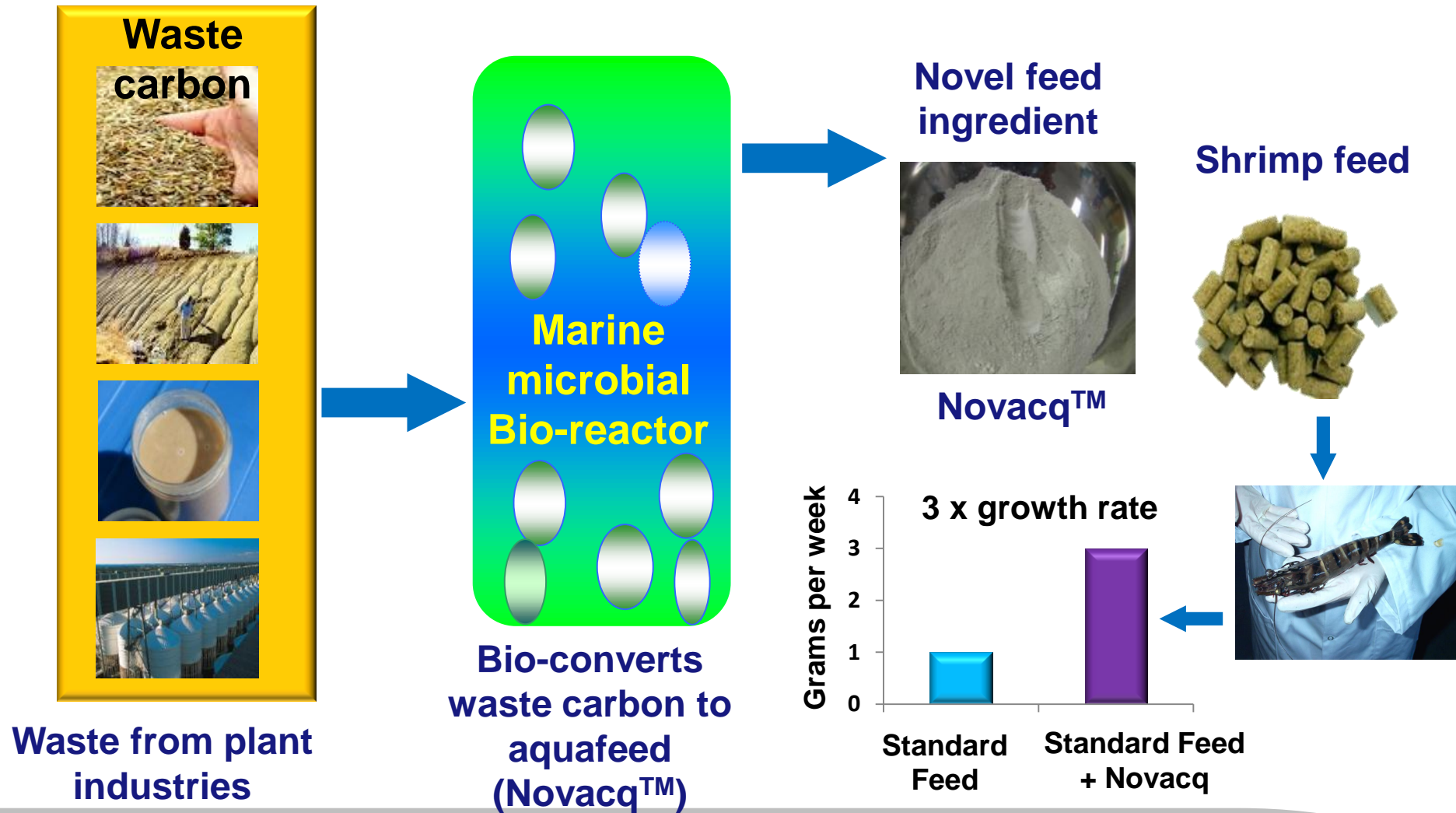


# Better Diets

[www.csiro.au](http://www.csiro.au)



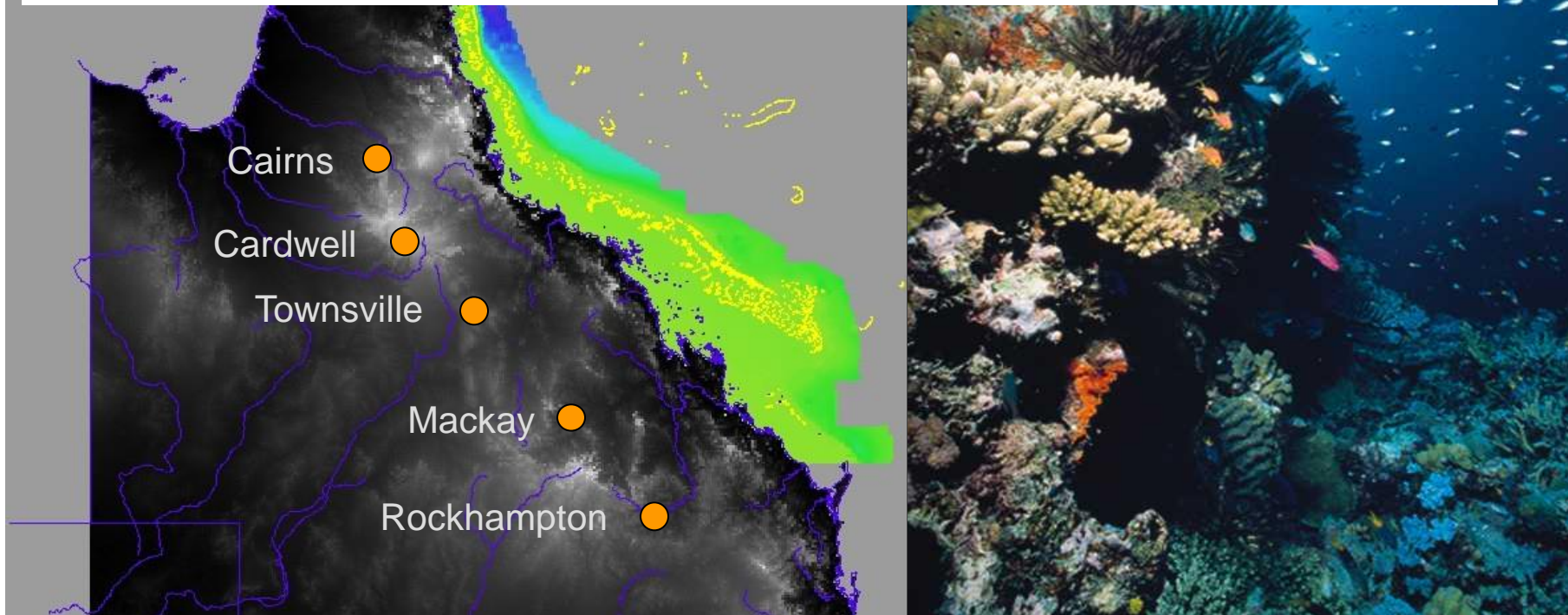
# Novacq: CSIRO technology converts waste carbon to aquafeed



# Co-existing with the Reef

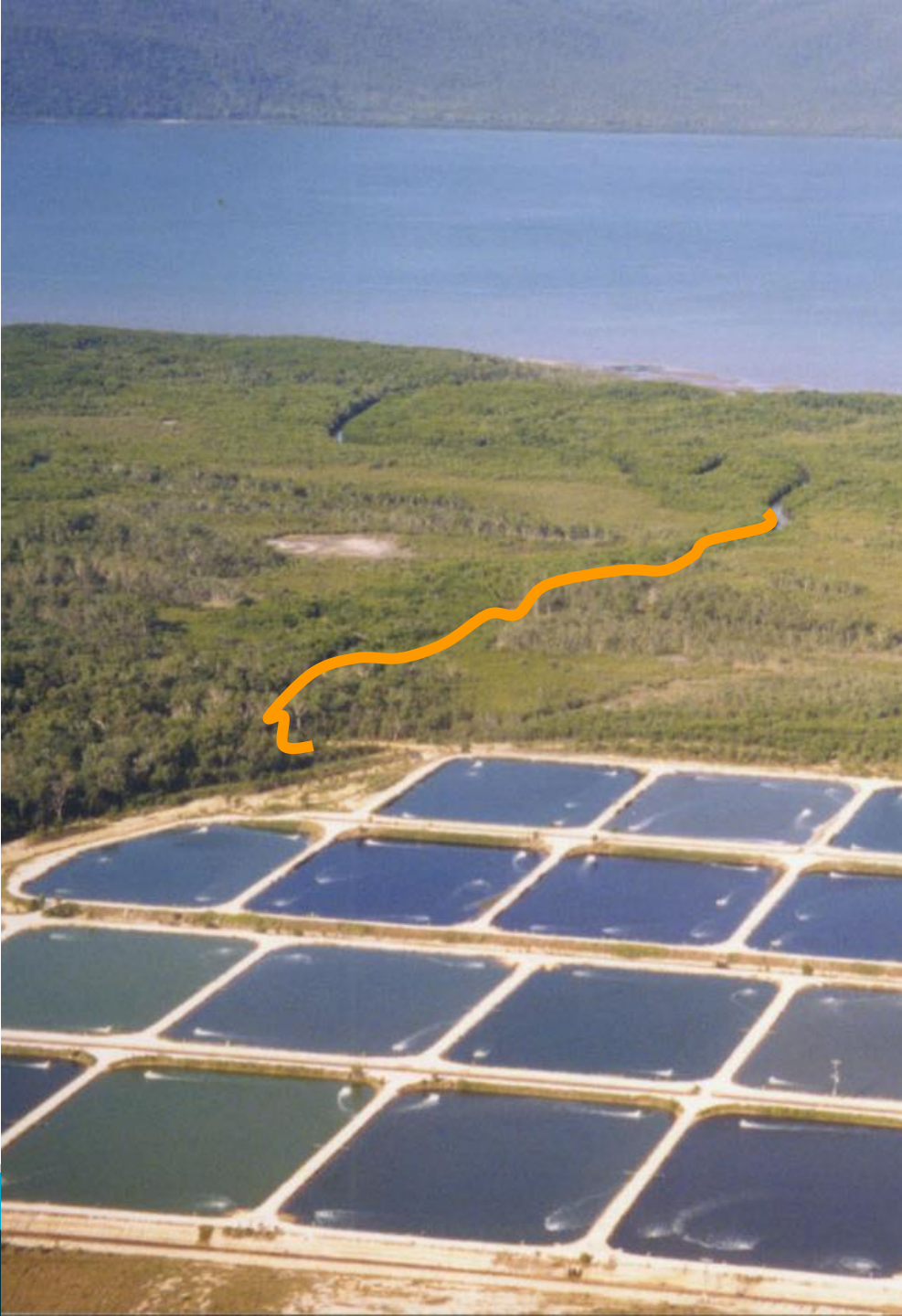
But we need to learn from the experience in Queensland

“The low nutrient environment of the Great Barrier Reef being inundated with aquaculture wastes, is similar to pumping out the sewage of cities containing thousands of people.” November 1999.



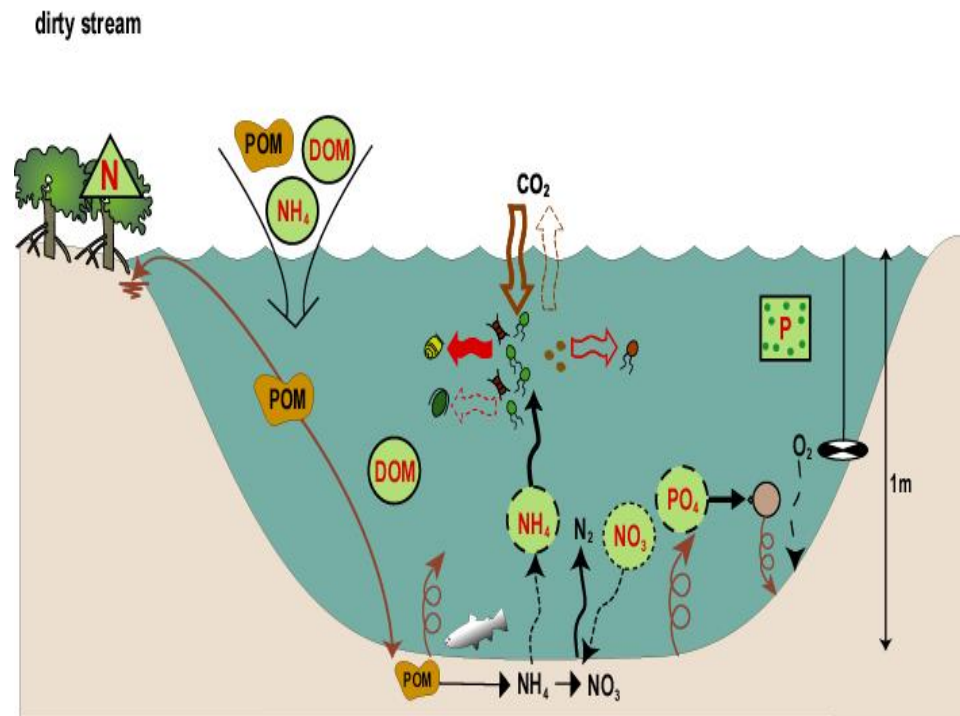
Brisbane ●

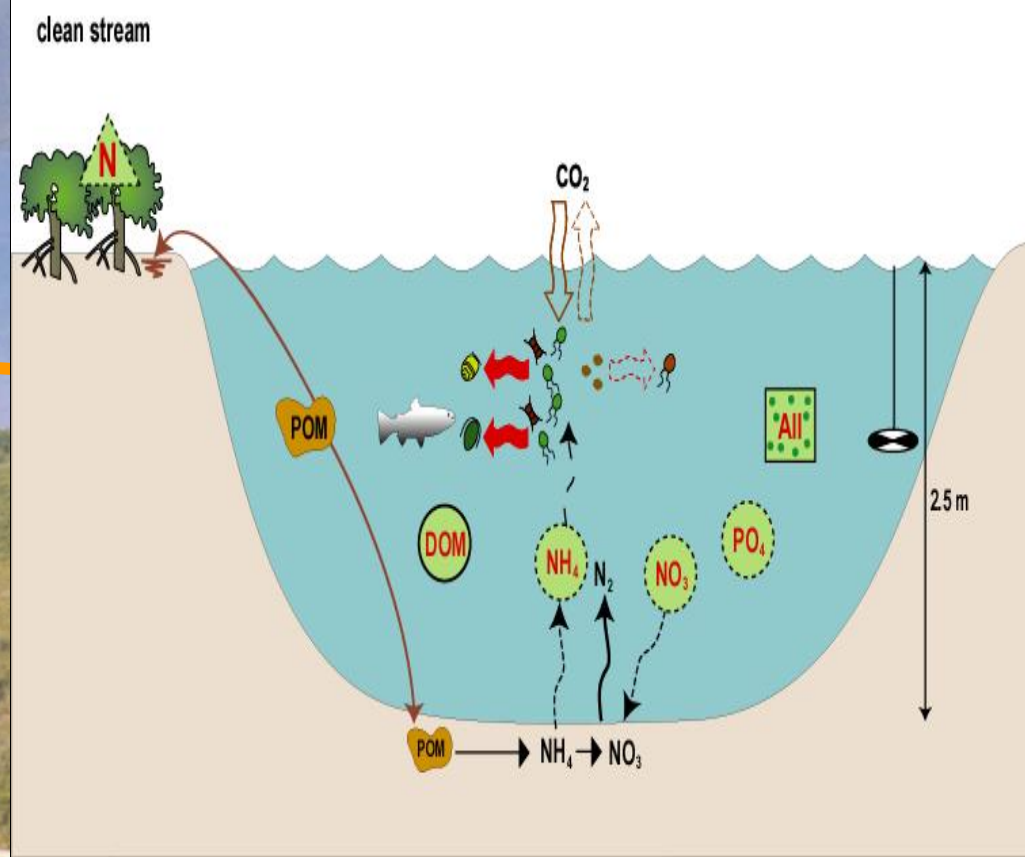
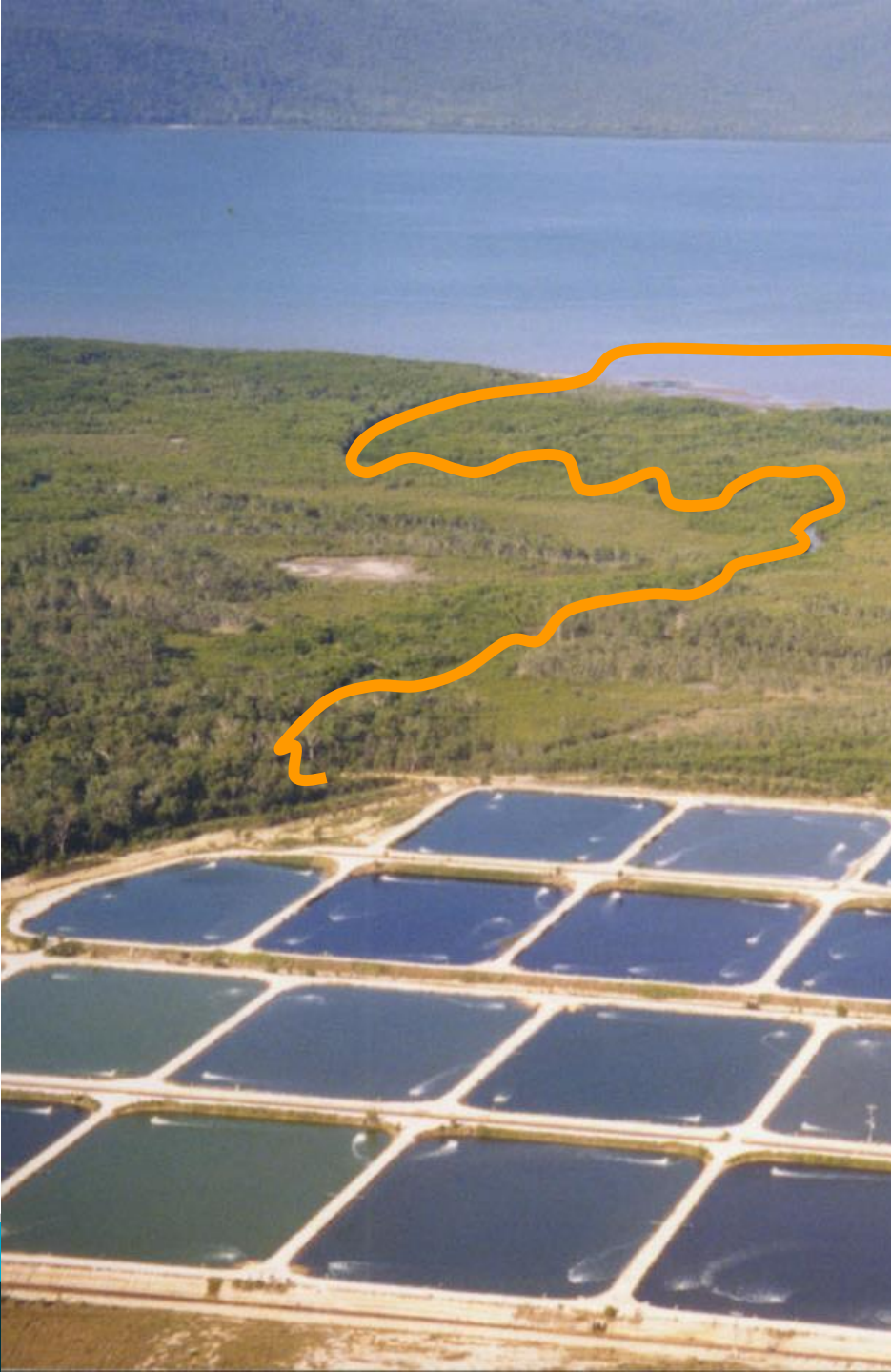




## Ponds to 0-2 km zone down a mangrove creek

- Higher primary production
- Minor effect on sediment processes
- $\delta^{15}\text{N}$  ratios elevated



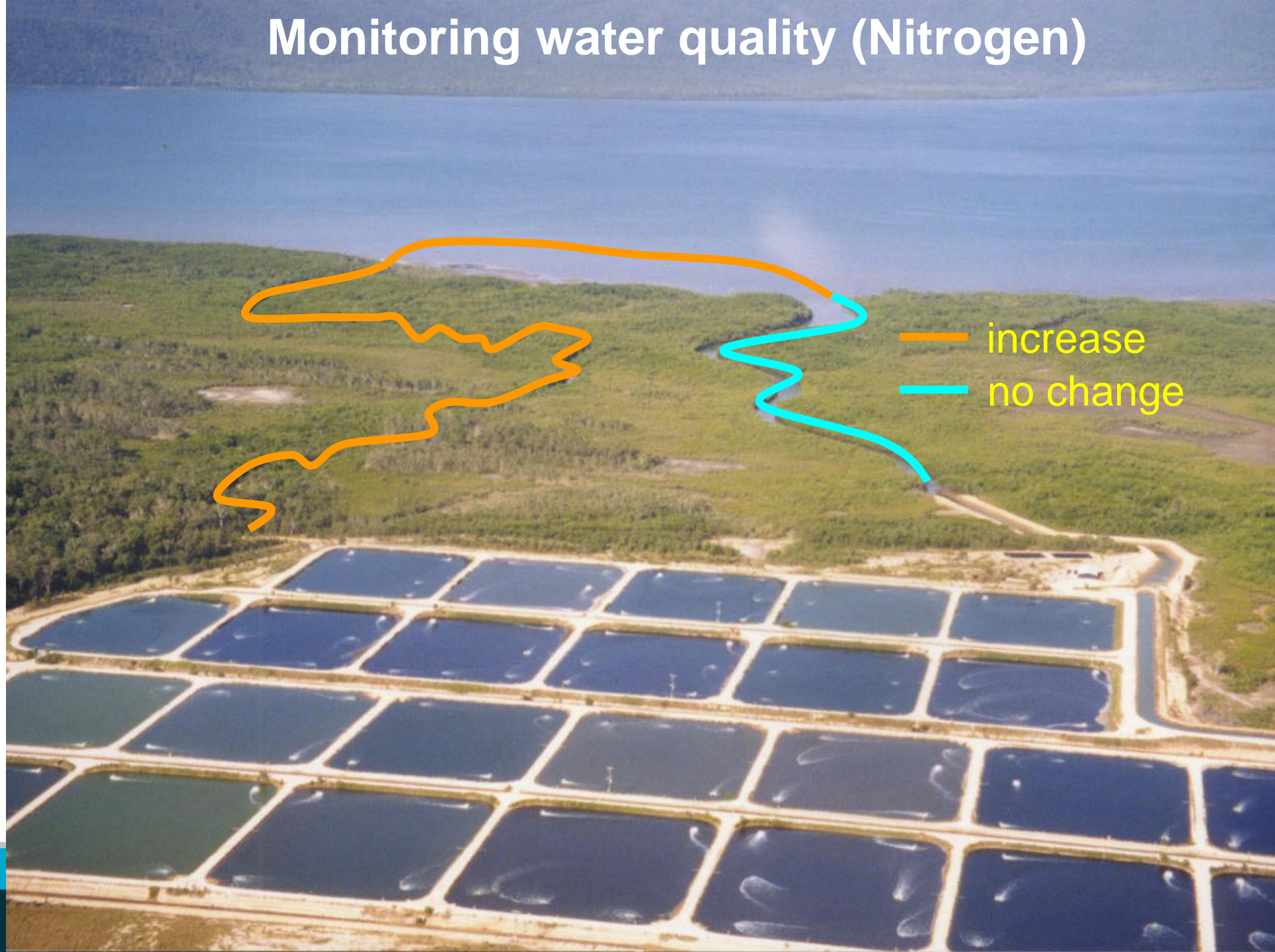


**>2km down a mangrove creek**

- **Lower primary production**
- **$\delta^{15}\text{N}$  ratios lower but still elevated**

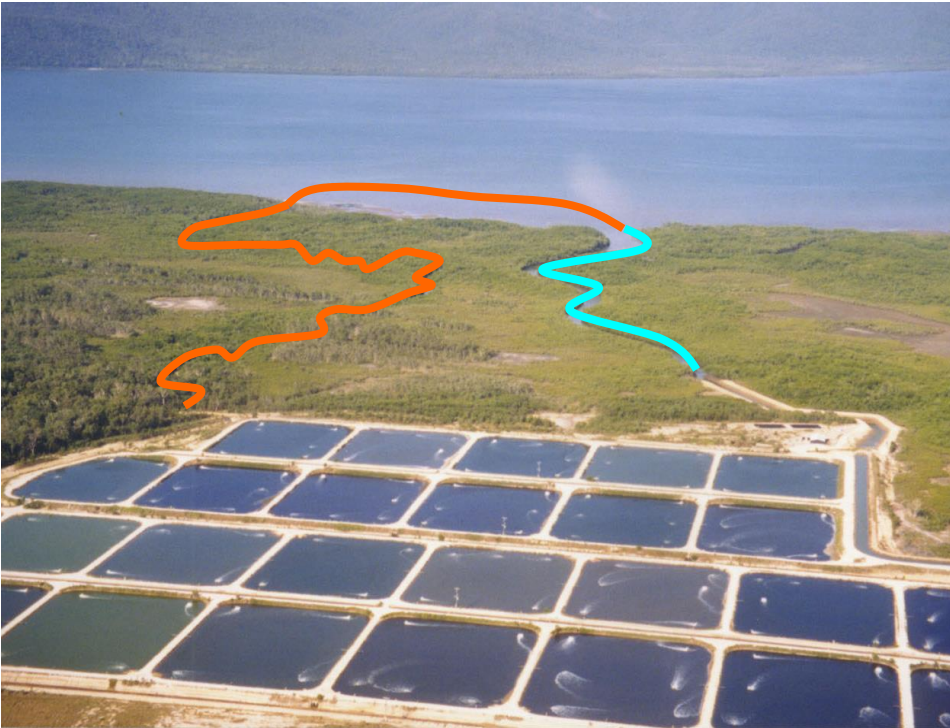


# Monitoring water quality (Nitrogen)

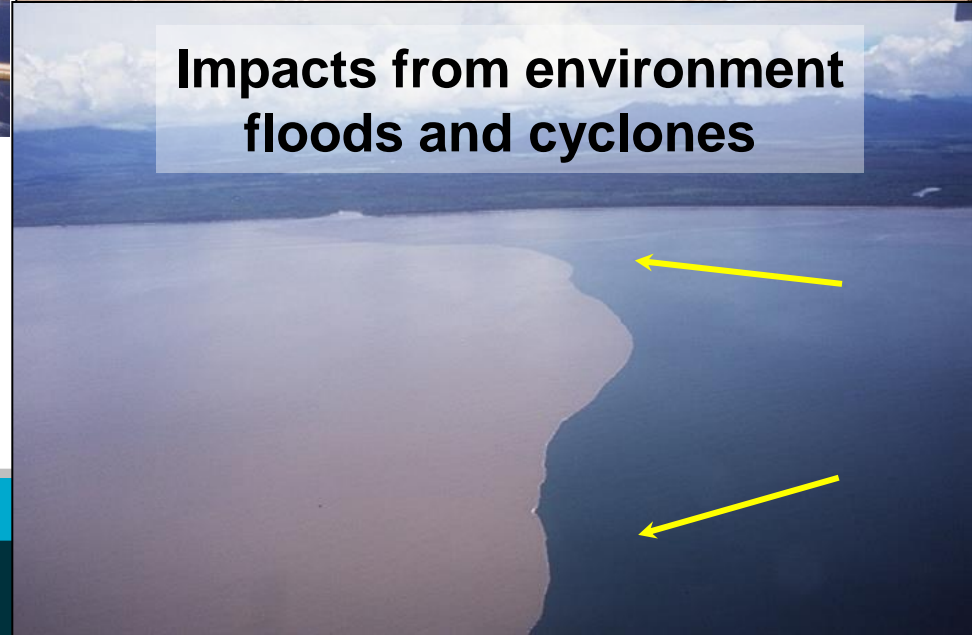




## So the outcomes were:



- transient impacts on small area
- opportunity for pond nutrient recapture & recirculation





# International science impact



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



Marine Pollution Bulletin 46 (2003) 1456–1469

MARINE  
POLLUTION  
BULLETIN

[www.elsevier.com/locate/marpolbul](http://www.elsevier.com/locate/marpolbul)

## A synthesis of dominant ecological processes in intensive shrimp ponds and adjacent coastal environments in NE Australia

M.A. Burford <sup>a,\*</sup>, S.D. Costanzo <sup>b</sup>, W.C. Dennison <sup>b</sup>, C.J. Jackson <sup>a</sup>, A.B. Jones <sup>b</sup>,  
A.D. McKinnon <sup>c</sup>, N.P. Preston <sup>a</sup>, L.A. Trott <sup>c</sup>

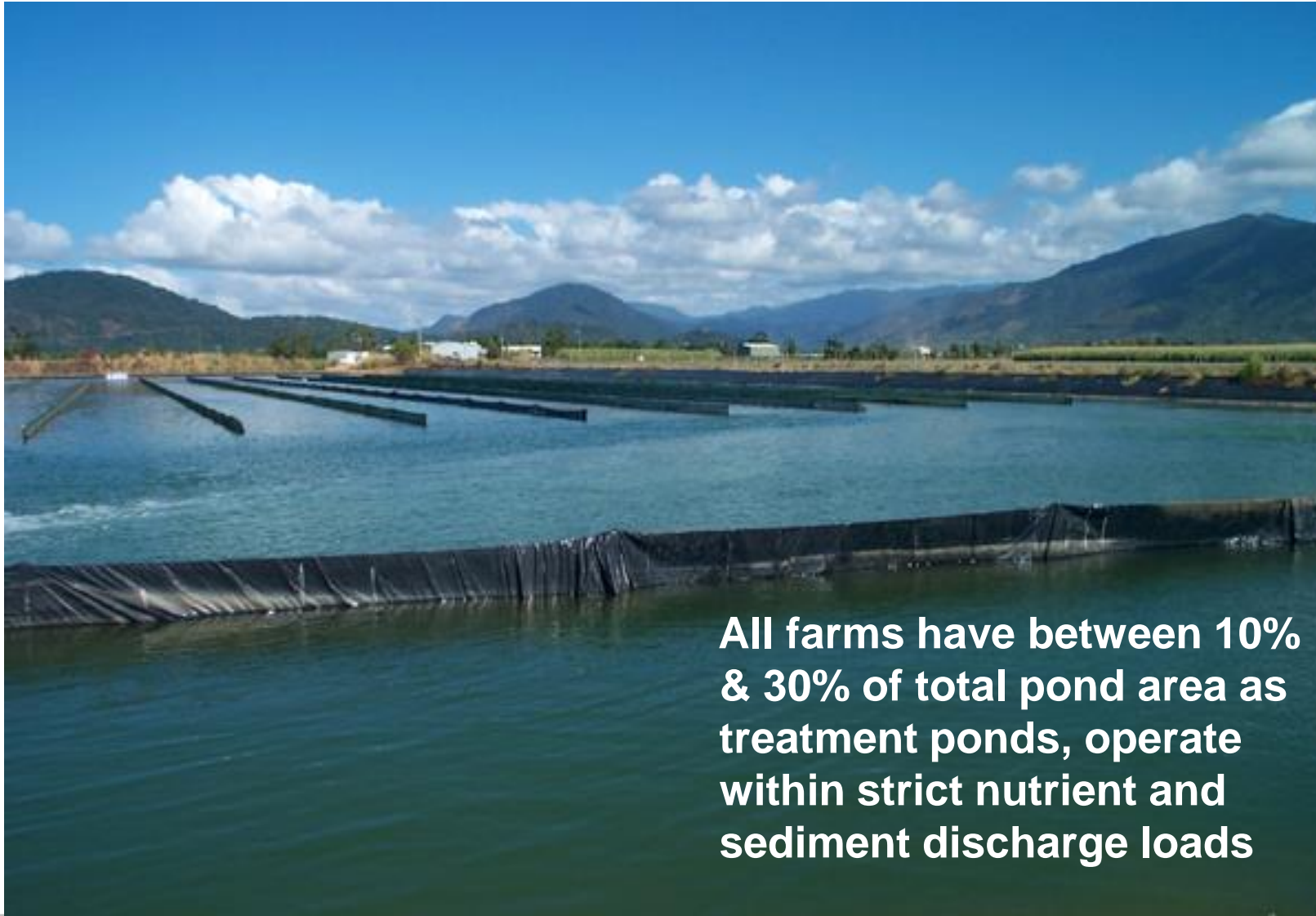
<sup>a</sup> CSIRO Marine Research, P.O. Box 120, Cleveland, Qld. 4163, Australia

<sup>b</sup> Department of Botany, The University of Queensland, St Lucia, Qld. 4072, Australia

<sup>c</sup> Australian Institute of Marine Science, PMB No. 3, Townsville, Qld. 4810, Australia

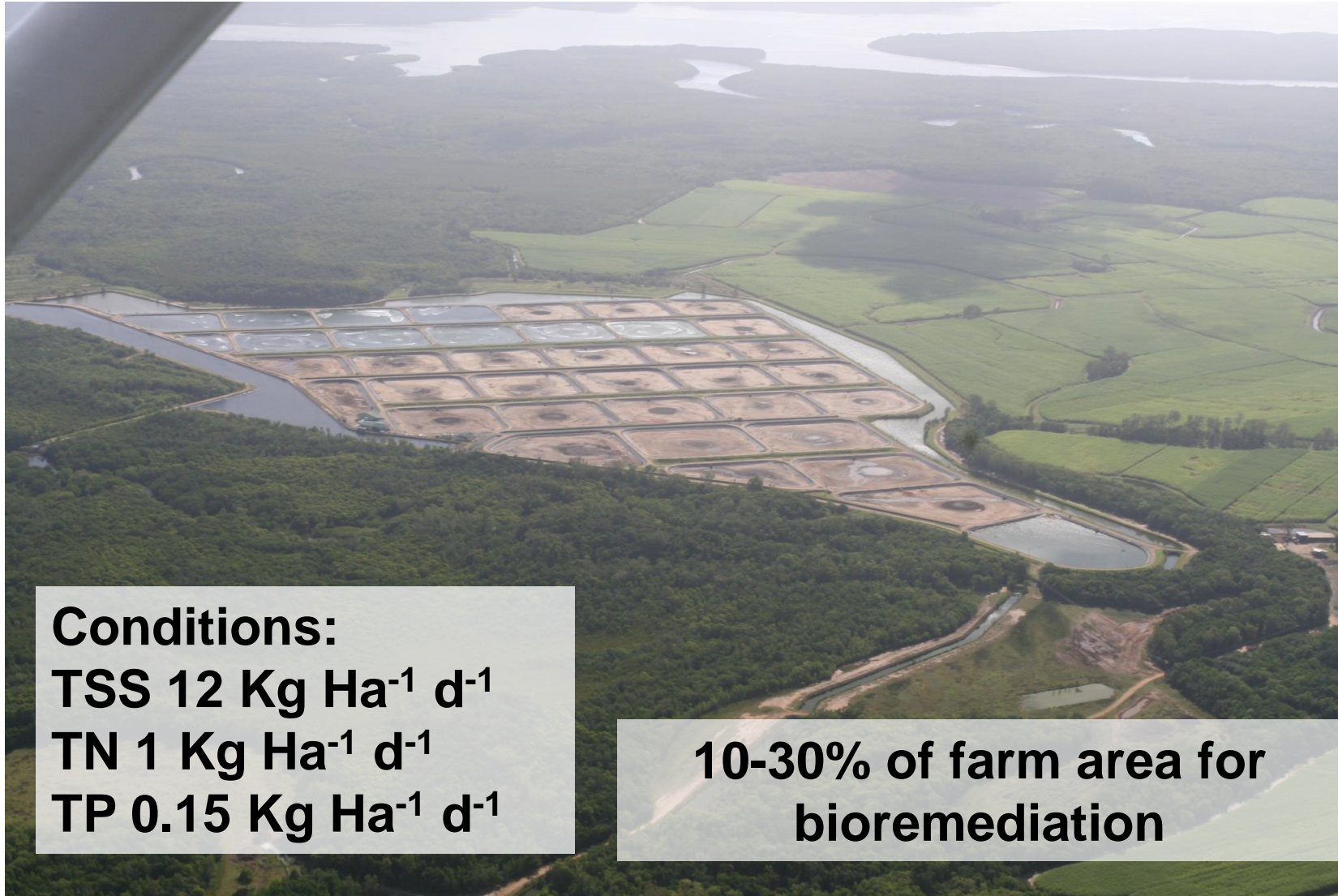
- Prawn pond discharges unique characteristics (higher phytoplankton)
- No detectable impacts on downstream sediment processes (tidal dynamics)
- Quantitative basis for predictive models of impacts (N, C & biota)
- Significant potential for recirculation and nutrient recapture

# Treatment and recirculation – adopted by all farms



**All farms have between 10% & 30% of total pond area as treatment ponds, operate within strict nutrient and sediment discharge loads**

# The strictest discharge licenses in the world



## Conditions:

TSS 12 Kg Ha<sup>-1</sup> d<sup>-1</sup>

TN 1 Kg Ha<sup>-1</sup> d<sup>-1</sup>

TP 0.15 Kg Ha<sup>-1</sup> d<sup>-1</sup>

10-30% of farm area for  
bioremediation



# Bio-floc systems adapted for Australian conditions



APF-CSIRO-



# Application of treatment technology

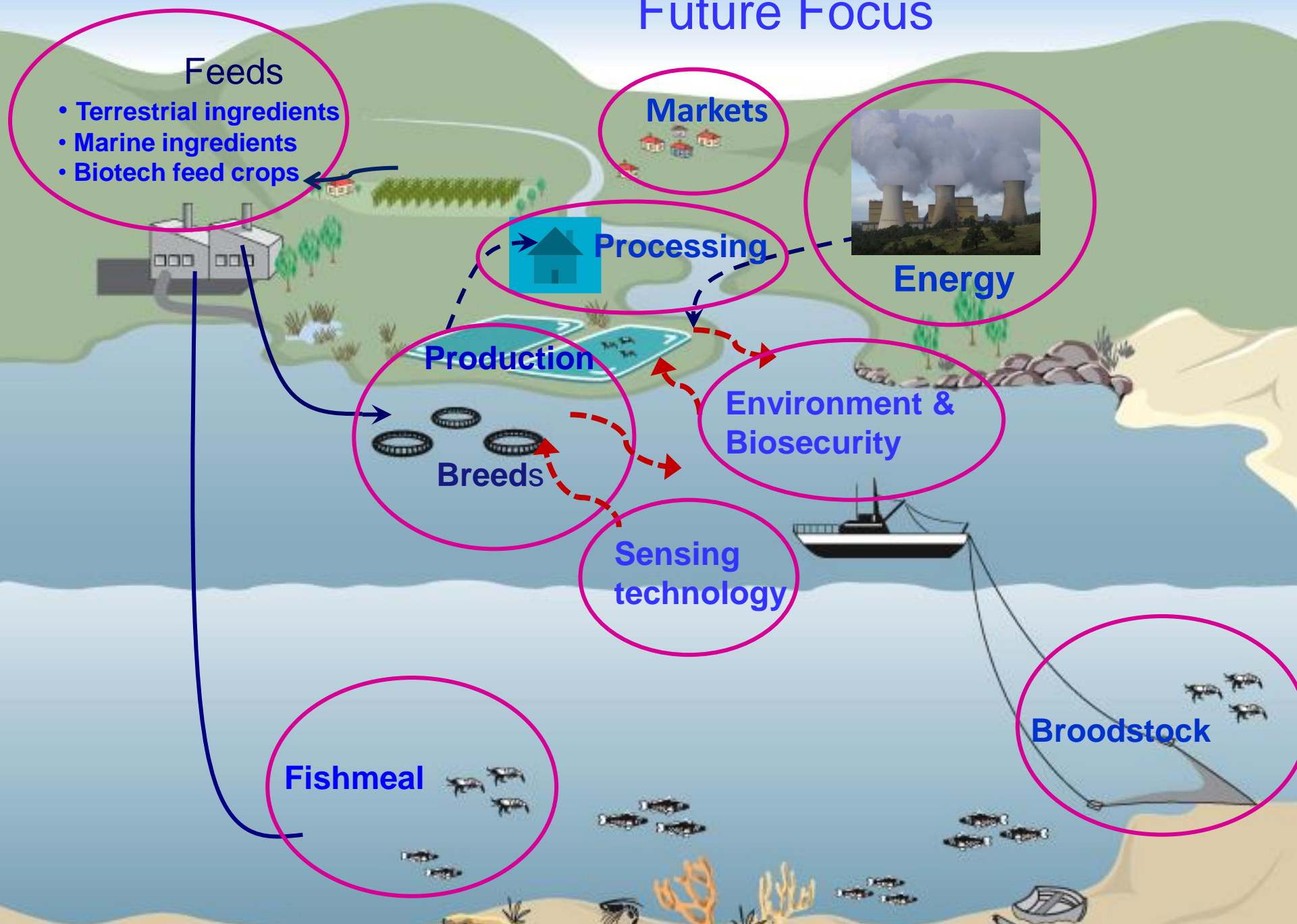


# The future

[www.csiro.au](http://www.csiro.au)



# Future Focus





# LEADING TECHNOLOGIES – WASTEWATER TREATMENT

JCU

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# Leading Wastewater Treatment Systems

- Prof Rocky de Nys (James Cook University)

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# BEST PRACTICE EXAMPLES – CASE STUDIES

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# Barramundi Industry Overview

- Prof Rocky de Nys (James Cook University)

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# Barramundi (Mainstream Aquaculture)

- Founded in 2001 – vision to build a “business for the future” as world’s leading provider of Barramundi
  - 10 years of R&D has developed proprietary technology
  - year round high quality production of Barramundi.
- largest recirculating aquaculture system in Melbourne and pond production system in Far North Queensland
- Advanced selective breeding program
  - world’s largest Barramundi hatchery in Melbourne)
  - R&D with JCU in Townsville
  - supply of high quality juvenile Barramundi that demonstrate rapid growth, low growth variance, high fillet yield and disease resistance.
- Mainstream distributes
  - food products into premium retail outlets and restaurants around Australia and
  - exports juvenile Barramundi to 24 countries across 5 continents.

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# Prawns – Seafarms Group

- Currently Australia's largest producer of farmed prawns. ASX-listed with current market capitalisation of ~ A\$183 million
- 160 ha of ponds, operational since 1988, produces with capacity to produce in excess of 1,800 tonnes pa
  - Banana and Black Tiger Prawns
  - Vertically integrated sales marketed under the Crystal Bay brand
- SFG has invested over A\$100 million advancing Project Sea Dragon since 2011



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# WEST ROCKHAMPTON AQUACULTURE PROJECT

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# FISH SPECIES

## NATURAL TO CENTRAL QUEENSLAND



**BARRAMUNDI**

(Barra, *Lates calcarifer*)



**COBIA**

(Black kingfish, *Rachycentron canadum*)



**MANGROVE JACK**

(Jacks, *Lutjanus argentimaculatus*)



**TIGER PRAWNS**



**BARRAMUNDI COD**

(*Cromileptes altivelis*)



**CORAL TROUT**

(*Plectropomus leopardus*)



**RED CLAW**

(Queensland red claw crayfish, *Cherax quadricarinatus*)



**SEA CUCUMBERS**



**QUEENSLAND GROPER**

(Queensland grouper, giant grouper, *Epinephelus lanceolatus*)



**RED EMPEROR**

(Reds, *Lutjanus sebae*)

# Preliminary Investigation Findings...

- More feasible to decommission, demolish and remove the existing WRSTP facilities and commence with a vacant clear site to undertake potential aquaculture activities...
- The WRSTP (and adjacent Rockhampton Clay Target Club) site are registered contaminated sites, but
  - contamination has not been characterised or quantified...
- Ongoing management of below-ground contamination is likely to have a considerable impact on the planning for above-ground activities including rezoning, any sale, leasing of the site for aquaculture...



# Preliminary Investigation Findings...

Preliminary feasibility for integrated RAS facility, Visitor Centre and Teaching Facility undertaken



Facilities footprint can be located on any suitable site...



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# BAJOO L & MARMOR ADAs

CSIRO & BLUESHIFT CONSULTING

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**PROPOSED WEST  
ROCKHAMPTON  
AQUACULTURE PRECINCT**  
1.7 HA

**INTERNATIONAL  
AIRPORT**

7HRS ROCKHAMPTON TO  
SINGAPORE

7.5HRS DRIVE - ROCKHAMPTON  
TO BRISBANE

45 MIN FLIGHT -  
ROCKHAMPTON TO BRISBANE

**CAPITAL OF  
CENTRAL OLD**

300 DAYS OF SUNSHINE  
SUBTROPICAL

**POPULATION  
CHARACTERISTICS**

APPROX. 85,000 PEOPLE

**ROCKHAMPTON AIRPORT**

**ROCKHAMPTON**

**GRACEMERE**

**QUT UNIVERSITY**

**KEPPEL BAY**

**FITZROY DELTA**

- 70,000 ha in size = 700 square kilometres
- Singapore in size = 721 square kilometres
- Home to barramundi and threadfin
- Independent monitoring for physio-chemical indicators rate is excellent (Ecosystem Health Report)

**FITZROY RIVER**

**FITZROY RIVER**

**FITZROY RIVER**

**BRUCE  
HIGHWAY**

**ROCKHAMPTON  
REGION AQUACULTURE  
DEVELOPMENT AREAS**

**PORT ALMA  
SHIPPING TERMINAL**



**BAJOO**

33MIN ROCKHAMPTON TO BAJOO

**PORT ALMA ROAD**

**MARION**



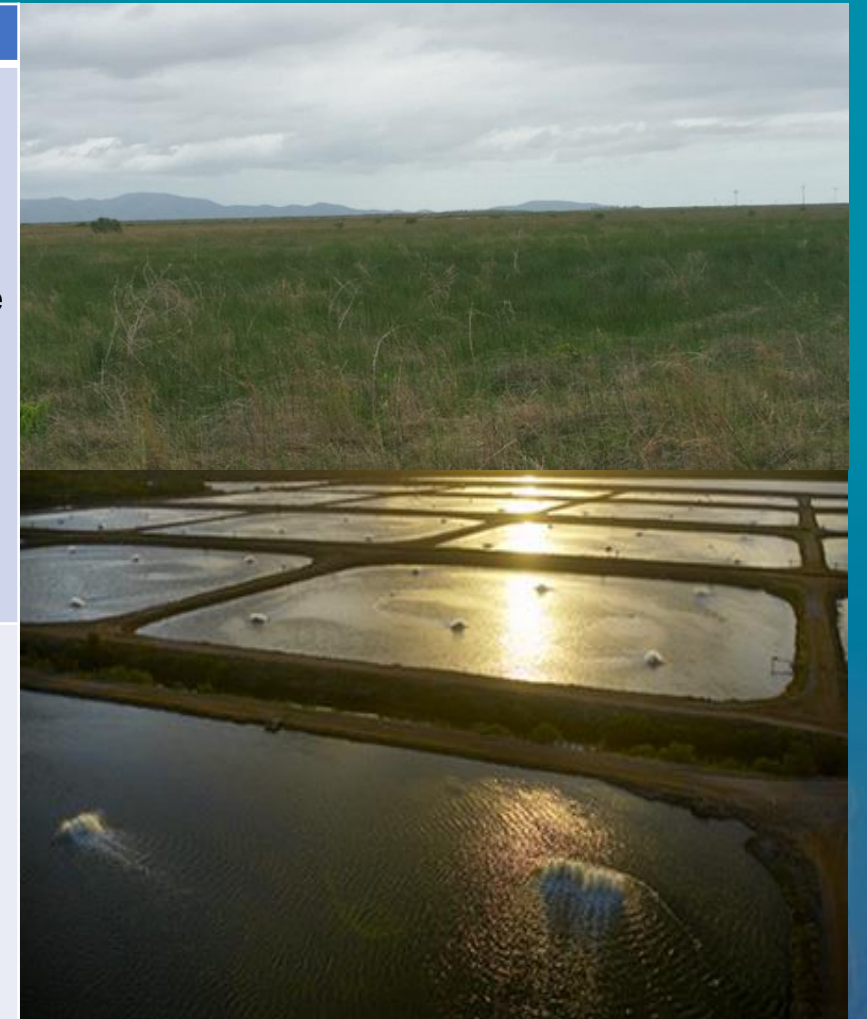
# Bajool & Marmor ADAs – general comments

- Both ADAs have good natural advantages for pond-based aquaculture and provide the region with a fantastic opportunity to kick-start strong aquaculture industry
- Climactically - region sits between lower range of tropical temperatures/species distributions and the upper range for temperate conditions/species
  - species selection will be important
- Size of the ADAs (particularly Bajool area) provides substantial scope for strategic 'master planned approach' to industry development
  - developing 'industry cooperative' structure
  - enable sharing of development costs (common user headworks and infrastructure), reducing duplication, unnecessary competition an
  - promoting opportunities for operational costs savings, regional cooperative brand development, marketing and sales.
- Aquaculture development still require several State permits
  - could still be considerable barrier particularly for small and new entrant participants.
- ADA's do not directly discharge into the GBR Marine Park, but...
  - position of GBRMPA is still not certain...
  - strategic master planning approach, engaging GBRMPA, provides best opportunity for successful outcomes
- Small number of landowners for Bajool ADA is significant advantage to achieving a strategic development approach
- Smaller landowner parcels may be more difficult to develop as standalone pond-based operations...
  - may need to be amalgamated to be viable..?
  - Smaller blocks – suitable for smaller, intensive, closed/RAS operations (or hatcheries) but market can support only a few...
- A strategic planning approach provides best opportunity to leverage funding such as: Northern Australia Infrastructure Fun. (NAIF) traditional agri/infrastructure funding, and foreign and domestic private equity investment.



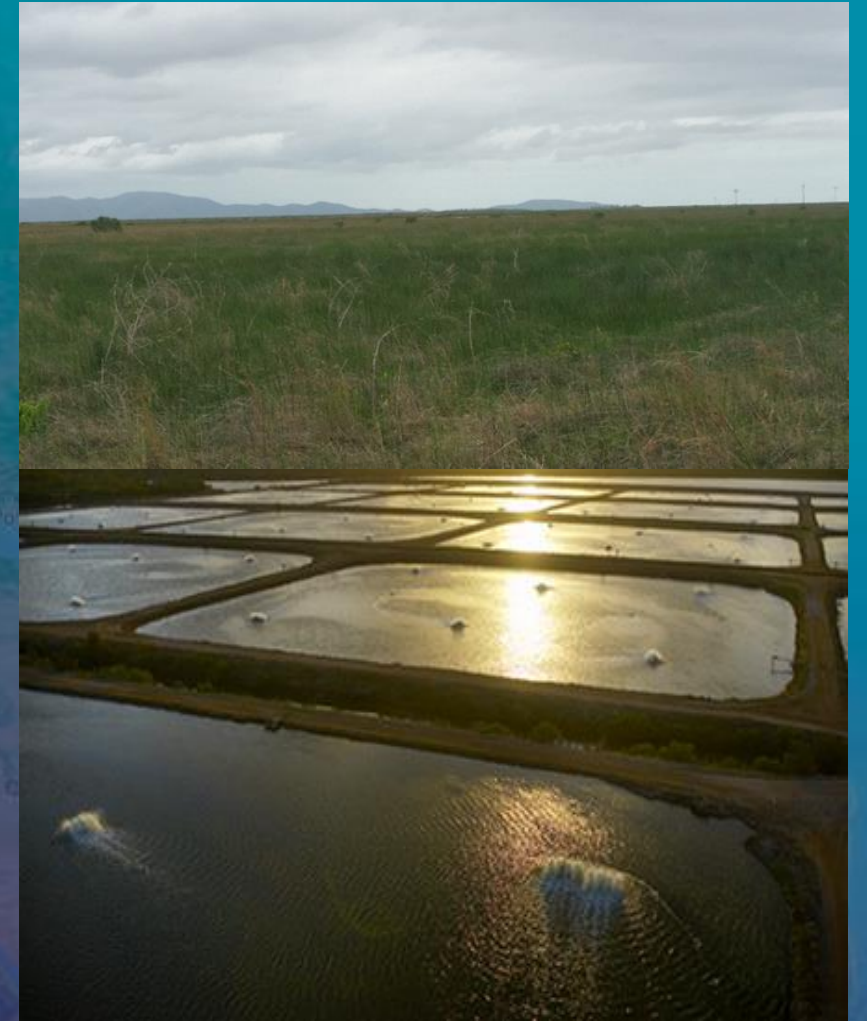
# Bajool ADA

|                                     | Issues  |
|-------------------------------------|---|
| <b>Strengths/<br/>Opportunities</b> | <p>Good local &amp; State govt support and community feedback.</p> <p>Separated from intensive agriculture or industry. Separated from residential areas.</p> <p>Large, relatively flat areas close to seawater source that appear to have adequate clay content and impermeability characteristics requisite for unlined earthen aquaculture ponds.</p> <p>Good access to power, roads and proximity to Rockhampton airport.</p> <p>Only 14 parcels of land and small number of landholders.</p> |
| <b>Weaknesses/<br/>Threats</b>      | <p>Fragmentation of land within ADAs could reduce prospect of large-scale project(s).</p> <p>Still some unknown risks/possible lengthy licensing &amp; approvals processes, particularly unknown future position of GBRMPA..?</p> <p>May still be need for investment guidance/ vetting to ensure highest potential projects supported and potentially marginal/higher risk projects dissuaded/deferred.</p>  |



# Bajool ADA

- Best prospects
  - large scale prawn pond production
  - 150 – 500 ha scale
  - ~8 tonnes/ ha (av. yield)
    - 1200 – 4000 tonnes per annum...?
- Prawn economics strong
  - \$11 – 13 / kg production costs
    - feed – 33%
    - labour – 33%
    - power – 33%
  - \$19 – 21 /kg wholesale price
  - \$30 – 60 /kg retail
    - Strong incentives to achieve vertical integration...





# Bajool ADA

- Land economics \*\*\*
  - \$1,000 – 2,000 ha – unimproved land value..?
  - \$150,000 - \$200,000 ha development costs
    - Canal headworks
    - Ponds
    - incl. hatchery & processing costs
- Prawn economic models available through DAF
  - [www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture](http://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture)
  - <https://publications.qld.gov.au/dataset/agbiz-tools-fisheries-aquaculture>
- Gross yields
  - \$40,000 – 60,000 /ha gross margin\*\*\*, but...
  - **Nett yields may be highly variable!**





# Marmor ADA

- Marmor – smaller land area, similar prospects, but...
  - may have some higher ecological sensitivities
    - greater development constraints than the Casuarina Creek ADA...
  - sections of Raglan Creek - high ecological value & Fish Habitat Area—Management A Zone
    - should be avoided for intake/discharge of water
    - Farm water quality/quantity supply from top of Raglan Creek (upstream of Fish Habitat area—Management A zone) or from Inkerman Creek may require assessment
    - Most of site located within coastal management district—any coastal hazard risks may need to be mitigated
- Category B—Remnant Vegetation & small sections of Category R—Reef-regrowth Watercourse Vegetation (surrounding areas)
  - north-west sections of ADA are partially located within the protected plants flora survey trigger overlays



# ROCKHAMPTON AQUACULTURE PLAN – NEXT STEPS

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# Rockhampton Aquaculture – Next steps

## Rockhampton Aquaculture Industry Development Plan

- West Rockhampton Aquaculture Precinct
  - Site contamination issues determined...?
  - High-level business cases to be completed
    - ‘peppercorn rent’ opportunity for site creates strong economic attraction for developer/operator...

## Aquaculture Development Areas

- Supply Chain Development Plan
- Infrastructure Plan
- Education and Training Plan
- Environmental Plan
- Indigenous Aquaculture Opportunities Plan



# A Proven Process – Agribusiness...



## BIOSECURITY

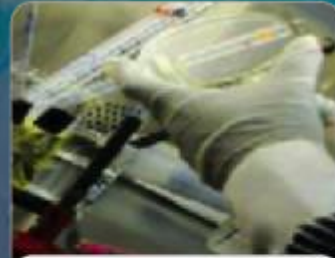
Australia – enviable reputation for biosecurity

Free of shrimp pathogens of significant consequence

Design biosecurity into the project from concept

World leading technology and science

Diagnostics and surveillance



## SHRIMP HEALTH AND DIAGNOSTICS

Biosecurity planning

Disease surveillance

Health training

Diagnostic laboratory and services



## BREEDING

Specific indoor biosecure site

Primary site and mirror site

Clear breeding objectives

Marker assisted selection

Drive alignment between GO and BP



## MULTIPLICATION CENTRE

Dedicated facility and mirror sites

Produces broodstock for supply to commercial hatchery

Post-Larvae supplied from Breeding Program

Size section before sending to hatchery

Best indoors

Infrastructure designed and located to get best spawner performance



## HATCHERY OPERATIONS

Biosecurity key and strict protocols

Physically isolated location

Designed and operated for best survival and PL quality

Strict QA protocols for PA acceptance

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# A Proven Process – Agribusiness...



## SHRIMP PRODUCTION

Technology used to reduce costs:

Automated feeding

Automated water monitoring

Centralised data control

Growth & Stocking strategies chosen to provide optimal margin per ha per day

Maintaining dissolved oxygen concentration critical to optimise profitability

Applied science to improve FCR growth rates and harvest accuracy



## FEED MILL

Significant variable cost

Contribute to low cost producer status through Feed Conversion Ratio (FCR)

Nutritionist to optimise cost

Most feeds to be delivered in bulk to the farm



## HARVEST

Shrimp harvested directly into slurry ice

Semi automated system

Core temperature is maintained below 40°C

Delivered to the Processing Plant within 1 hour



## PROCESSING

~500 tonne capacity per day

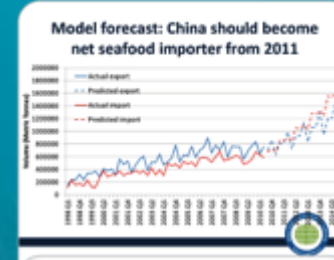
Freezing capacity of 31 tonnes per hour

Driven by quality

Automated, low labour technologies

Standardised packaging and product outputs

Soft shell and loose shell rejects – Individual Quick Frozen (IQF) for reprocessing offshore



## SALES AND MARKETING

Focus on export markets

China's growing middle class

Off-take agreements

Standardised product:

3 core brands

Private labels

70% sales to Asia



# QUESTIONS?

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# APPENDICES

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# Why Aquaculture?

- Globally, aquaculture is a large and fast growing industry, with Australia's emerging industry well placed for growth and international penetration

## Strong macro trends

- Global Aquaculture is a ~\$119bn industry<sup>3</sup> and production is forecast to increase 77% from 2008 to 2030
- Increasing global demand for seafood
- Driven by increasing population and per capita consumption
- Wild catch fish supply is constrained, aquaculture is required to meet growing demand

## Australia is in a production deficit

- Australia is a net importer of seafood (\$450m), particularly prawns (\$305m)
- Demand exists for high quality Australian grown produce as product labeling laws evolve

## Substantial upside potential through scale and genetics

- While seafood has an attractive feed conversion ratio already, improvements such as those achieved in chicken are expected
- In prawns, wildcatch broodstock are used to provide infants which results in random genetics and limited scale for improvement
- Strong genetic improvements [14.4% per annum]<sup>1</sup> have been achieved in Australian prawns through the development of domestic broodstock programs
- Improvements in salmon fish size have been achieved in Australia [16.6% per annum]<sup>2</sup>, however there has been limited improvement in other fish in western production regions at large scale
- Benefits from scale expected through investment in technology and centralisation e.g. processing and distribution

## Fragmented industry / high barriers to entry

- Historically high levels of government intervention, limited licenses for production currently available
- Pipeline of acquisition targets established – first mover advantage
- Despite attractive economics, barriers to entry especially for foreign investors have been relatively high due to regulation, fragmentation, environmental restrictions etc.

## Potential to diversify across species

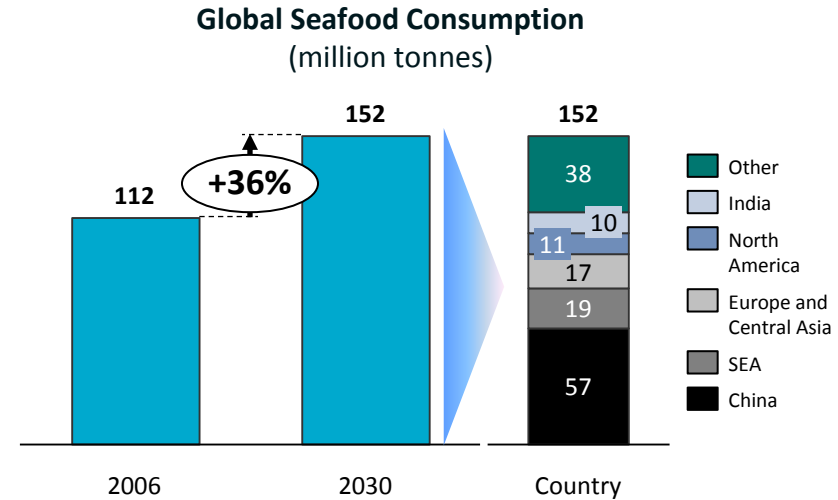
- Rapid progression occurring in Australian aquaculture species including prawns, salmon, barramundi, cobia and shellfish (abalone and oysters)

• 1. Annual rate of weight gain genetics related improvement 'James Cook University Prof Dean Jerry' Head of Aquaculture and Fisheries 2. Achieved by Tassal in 2011 (Annual Sustainability Report) 3 - <http://www.fao.org/docrep/016/i2727e/i2727e01.pdf>

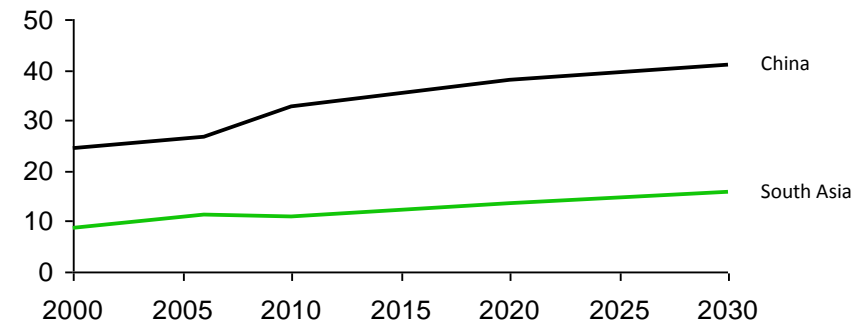
# Investment Highlights

## Global Demand

- Global seafood consumption is increasing, demand is driven by growth in Asia
- Seafood consumption is forecast to increase 36% from ~112 million tonnes to ~152 million tonnes between 2006 to 2030
  - China is forecast to be the world's largest seafood consumer in 2030 with over 57 million tonnes per annum
  - Chinese per capita consumption is forecast to increase 68% between 2000 and 2030
  - SEA consumption is expected to increase by 35% from 14m tonnes in 2006 to 19m tonnes in 2030



**Projected Per Capita Global Seafood Consumption**  
kg per capita; 2000 - 2030

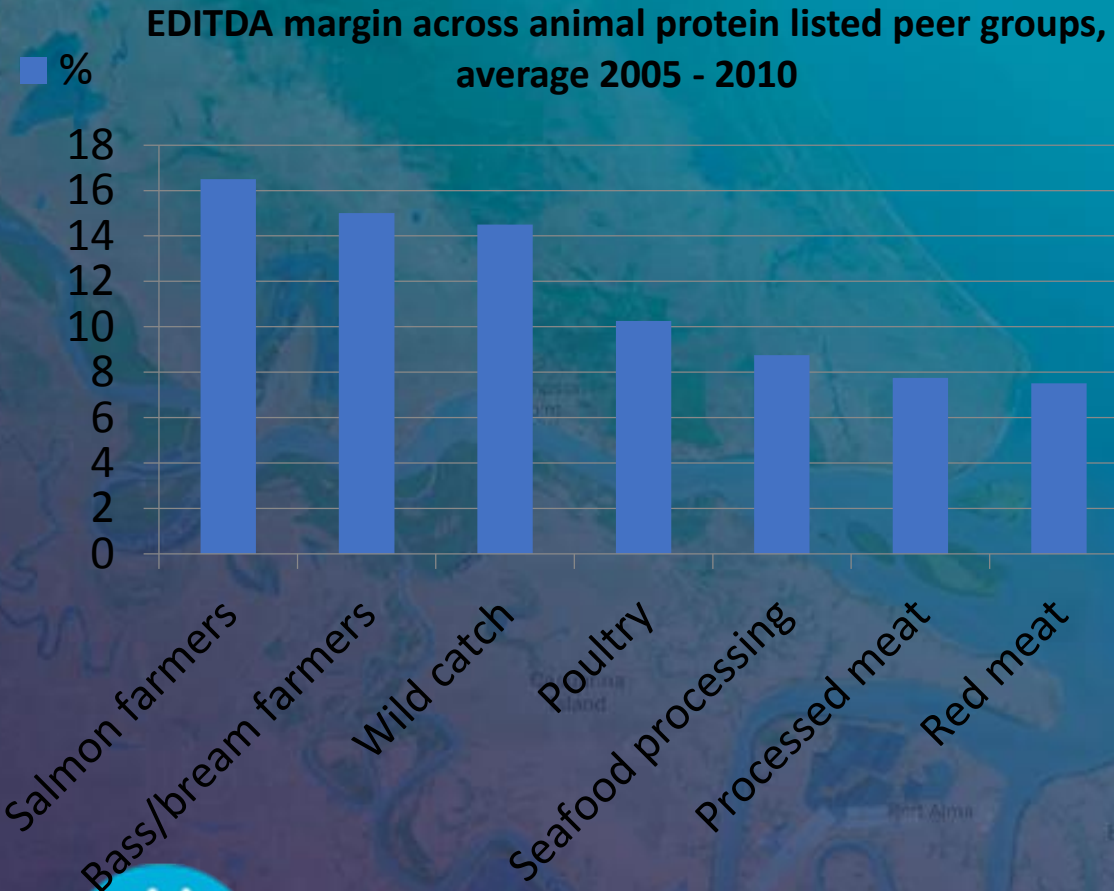


Source: FAO, OECD, ABARES



# Sector leading long-term profitability and growth...

- Certain segments of aquaculture industry can have high profitability
- Contributing factors include:
  - High barriers to entry
  - New technology
  - Positive demand function
  - Large asset base



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# Investment Highlights

## Global Investment Environment

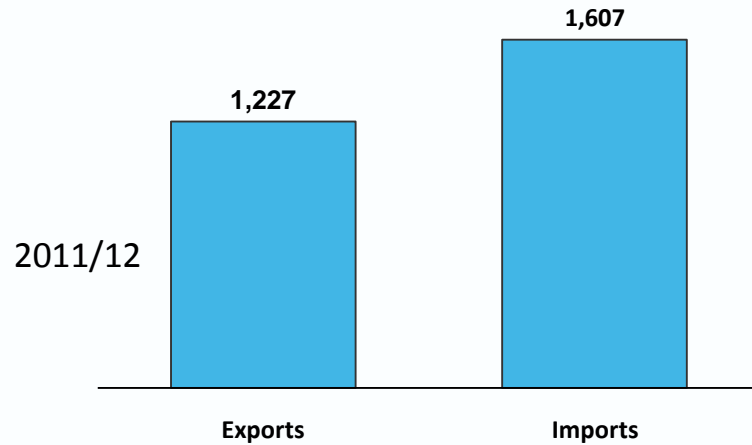
- A number of large aquaculture companies have grown from historically fragmented beginnings, largely in salmon and prawns

### Major Listed Global Aquaculture Companies

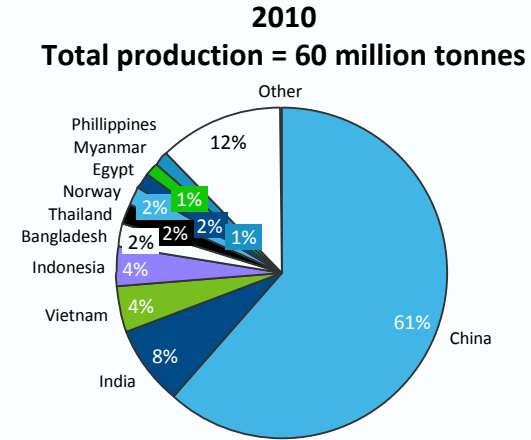
|   |  |
|---|--|
|    | <ul style="list-style-type: none"><li>• Based on Norway is the worlds largest farmed salmon producer and overall fish farmer</li><li>• Listed with a market cap of USD \$5.1bn</li></ul>   |
|    | <ul style="list-style-type: none"><li>• One of the largest added value diversified food producers in the world – includes shrimp feed production</li><li>• Based in Thailand</li><li>• Listed with a market cap of USD \$5.4bn</li></ul>                                   |
|    | <ul style="list-style-type: none"><li>• Largest shrimp exporter in Vietnam</li><li>• Established as a private enterprise in 1992; listed on Vietnam’s stock exchange 2006</li><li>• Estimated market capitalisation of ~\$350m (plans to raise~\$40m of capital)</li></ul> |
|   | <ul style="list-style-type: none"><li>• Australia’s largest aquaculture (predominately salmon) producer</li><li>• Market capitalisation of ~\$480m</li></ul>   |
|  | <ul style="list-style-type: none"><li>• Australia’s second largest aquaculture (predominately salmon) producer ; Market capitalisation of ~\$321m</li></ul>  |

Source: FAO, OECD, ABARES

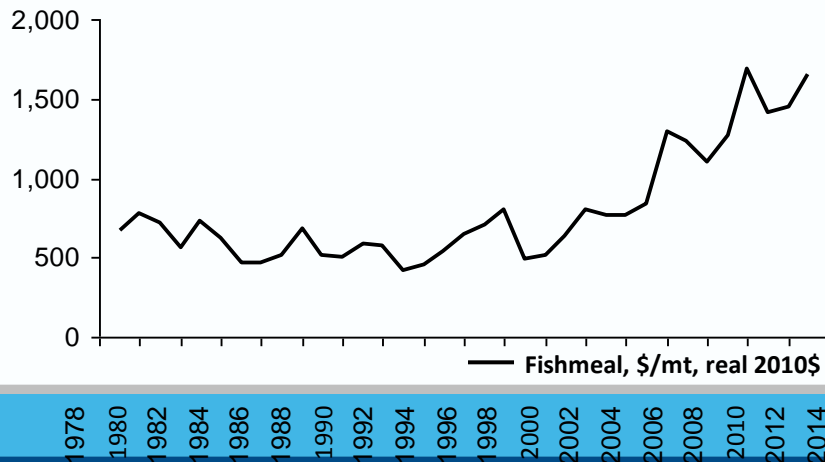
Value of Australian Fisheries Exports and Imports (millions)



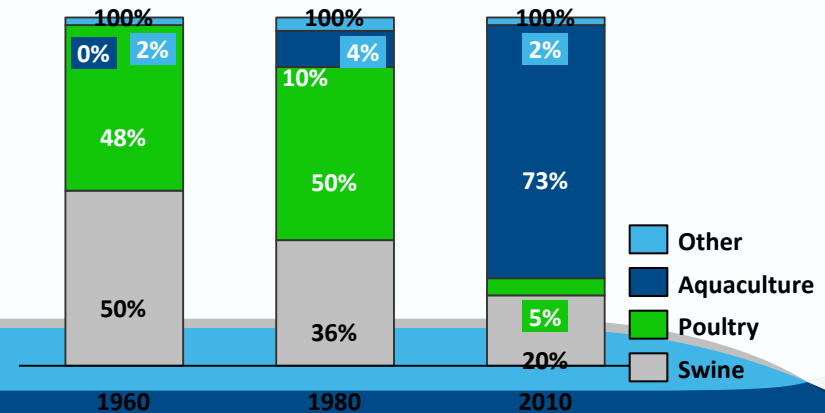
China is the largest aquaculture producer  
(8 out of the top 10 countries are Asian)



Fishmeal prices have increased sharply



Global Fishmeal Use

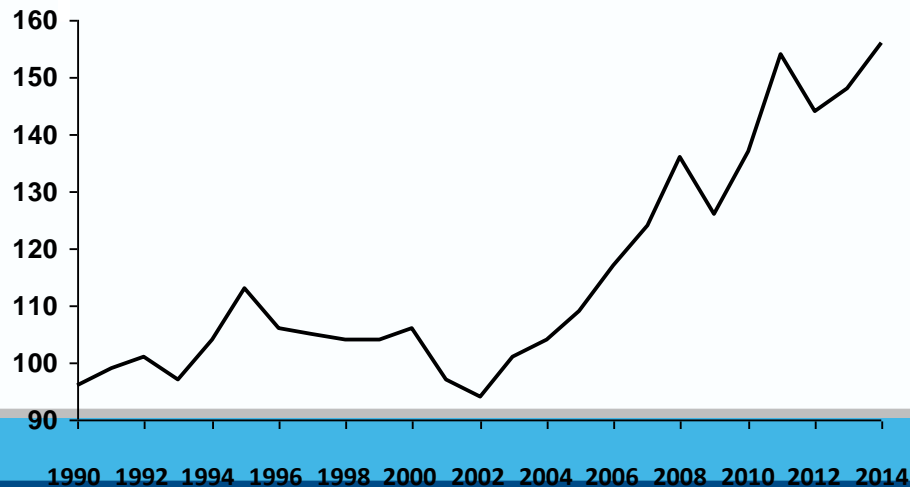




## Why Australia?

- Reputation for high quality (disease free exports)
- Proximity to Asia
- Emerging sector with proven technology
- Land/Coastline availability
- Fragmented market –small family owned or hobby farms

### Global Fish Price Index



## Macro Factors

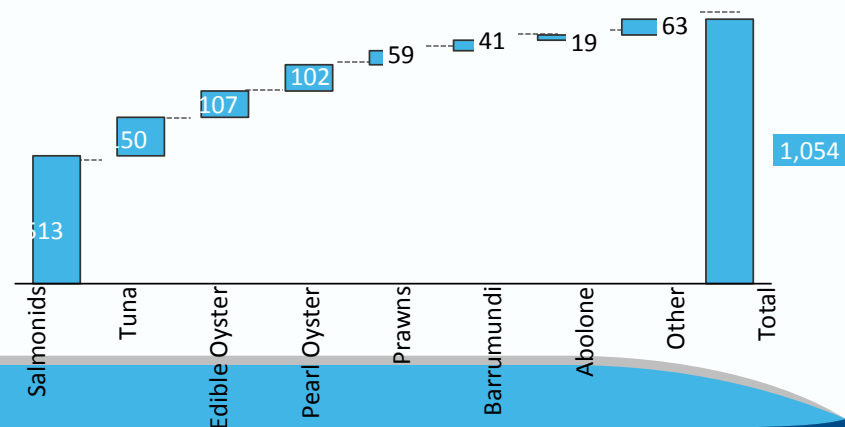
### Demand

- Rising global population
- Increasing incomes per capita (seafood consumption increases with higher incomes)

### Supply

- Limit of wildcatch fish available
- Growing aquaculture industry and production technology are supporting supply and demand balance

### Size and Composition of Australia's Aquaculture Market (2011/12 Millions)



# Rapid, unregulated expansion in Asia... an opportunity for Australia?

Growing concern over levels of contaminants in Asian cultured seafood products...

But Australian aquaculture production systems must be able to:

- Deliver high-quality, consistent volumes of produce
- Operate with minimal environmental impact
- Use sustainable input feed raw materials

Future of aquaculture systems lies in...

- Larger sea sites further from shore
  - E.g. Salmon
- Larger, more-sophisticated land-based production
  - Environmental constraints...?
  - Land competition...?



Alarm at antibiotics in fish imports

AUSTRALIAN medical experts have raised the alarm over a rising number of Asian fish imports containing banned antibiotics



**Seafood News Food Safety & Health**  
ABC News: Shrimp farms 'promote disease'

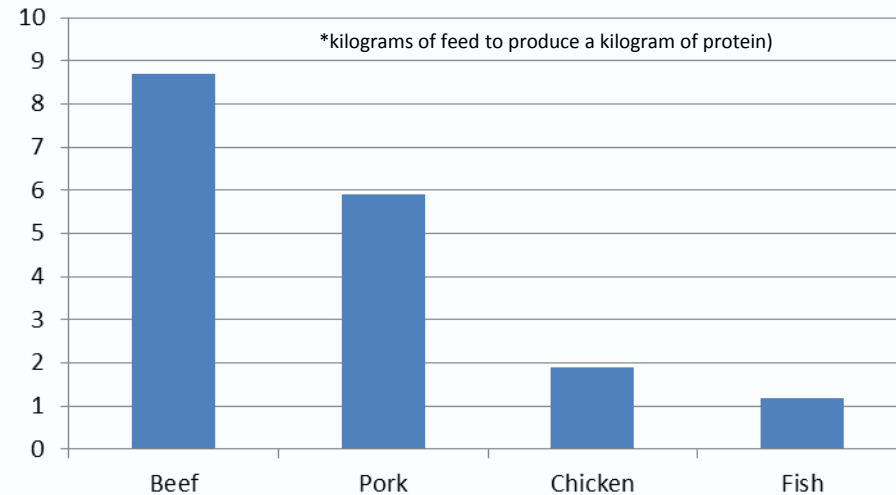
## Aquaculture

- produces 68Mtpa of finfish\*
- provides 47% of the 16.7 kg per capita fish consumption

Needs to produce ~4% (or about 2M tonnes) more marine protein per year

...50 % of the seafood industry will be responsible for 100% of future growth in demand.

Feed Conversion Ratios\* (FCR) of Major Animal Protein Sources



(Source: Food & Agriculture Organisation of the UN, 2011)

*Fish (and marine invertebrates) have the highest Feed Conversion Ratio (FCR) i.e. produce more available kilograms of protein per kilograms of feed...*

\* Includes freshwater fish



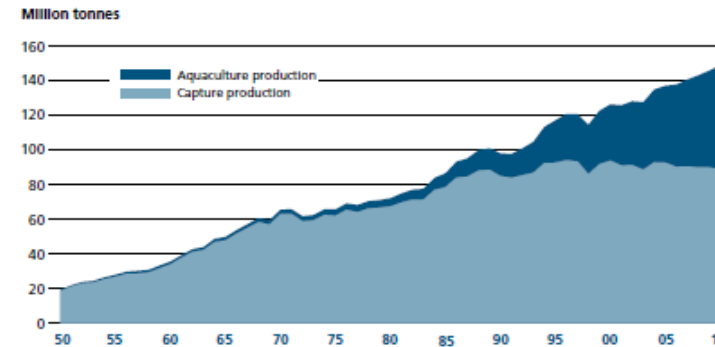
# Investment Highlights

## Global Supply

- Growth in global fish production is driven by aquaculture production, wildcatch production is relatively stable
  - Total fish supply (production) is expected to increase 32% from 142m tonnes in 2008 to 187m tonnes in 2030
    - Wild catch production is expected to grow only 3% over this period
    - Aquaculture production has grown at over 10% per annum from 1980 – 2000 and from 2000 – 2009 production growth was 6% per annum
    - Aquaculture production is forecast to increase 77% from ~53m tonnes in 2008 to ~94m tonnes in 2030 (CAGR 3%)
    - China accounts for 57% of global aquaculture production, however is rumoured to be experiencing substantial water quality issues limiting capacity for growth
    - Australia’s aquaculture industry is worth ~\$1bn in 2012/13 and largely predominately supplies the domestic retail market

**Fisheries Production 1950 – 2010**

Wildcatch v Aquaculture



**Forecast Fisheries Production 2011 – 2030**

% Of Production Wildcatch v Aquaculture

2011-Total 154 million tonnes

2030-Total 186.8 million tonnes



□ Wild Catch    ■ Aquaculture



AUSTRALIAN  
**Prawn  
Farmers**  
ASSOCIATION

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**Matt West**  
President  
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# Queensland Prawn Aquaculture

## Production data Queensland Prawn Farming FY2010 - FY2017

| Year (FY)              | 2010  | 2011   | 2012  | 2013   | 2014  | 2015  | 2016  | 2017  |
|------------------------|-------|--------|-------|--------|-------|-------|-------|-------|
| Value (\$)             | 71.7  | 54.3   | 56.8  | 56.6   | 59    | 81.2  | 78.6  | 76.6  |
| Prodn (t)              | 5115  | 3822   | 3751  | 3519   | 3487  | 4951  | 4302  | 4264  |
| \$/kg                  | 14.27 | 14.54  | 14.95 | 16.08  | 16.93 | 16.4  | 18.27 | 17.96 |
| Prodn (ha)             | 827   | 659    | 692   | 590 E  | 552.4 | 569.1 | 569.1 | 560 E |
| Prodn yield (t/ha)     | 6.18  | 5.8    | 5.42  | 5.96 E | 6.31  | 8.7   | 7.56  | 7.6 E |
| Farms Op (#)           | 23    | 20     | 20    | 19     | 22    | 22    | 22    | 21    |
| Hatch sales (\$)       | 1.3   | 1.3    | 1.1   | 2.7    | 2.7   | 1.4   | 1.9   | 1.2   |
| PL Prodn (M's)         | 382   | 319    | N/A   | N/A    | N/A   | 279   | 398   | 333   |
| Cost/PL (c)            | N/A   | N/A    | N/A   | N/A    | N/A   | 0.5   | 0.48  | 0.36  |
| No. of Spawners purch. | 2,471 | 1,990  | N/A   | N/A    | N/A   | N/A   | N/A   | N/A   |
| Spawners used          | 9,552 | 10,680 | N/A   | N/A    | N/A   | N/A   | N/A   | N/A   |



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